ÅKERSTRÖMS

Robust Radio remote control

# INSTALLATION MANUAL

# REMOTUS JUPITER
# Era 4/6/8B

**(RX160, AQ80)**

950454-000 EN -B2

## Revision history

| Version | Date | Reason |
|---|---|---|
| A0 | 2014-05-20 | 1st released version |
| B0 | 2014-09-26 | New transmitter configuration menu. New PLC affecting; tandem/multi-operator operation, two more program selections (EE and FF). |
| B1 | 2014-11-13 | Tandem operation; pairing transmitter to receiver 2 (B) changed |
| B2 | 2014-12-04 | Tandem/multi-operator operation, corrected |

## Reference

RX160 configuration tool, manual 949689-000.

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# 1 Introduction

Remotus is Åkerströms product family for radio remote control of safety critical industrial and mobile applications. Remotus Jupiter is Åkerströms' standardized industrial remote control product line.

The manual must be used when installing Åkerströms Remotus system to ensure a secure and safe operation. This manual only covers the installation of the Remotus radio remote control system. Remotus does not include a complete system for remote control: it has only a set of outputs that is controlled by the operator with the transmitter switches and joysticks. How the outputs are used to control the object (for example, a machine's movements and brakes) depend on the specific installation and is outside the scope of the Remotus system.

It is the responsibility of the Systems Integrator or Machine builder to safely incorporate the Remotus radio remote control into the complete system or machine. The System Integration has to be made by qualified personnel applying the appropriate standards for the system or machine including making the necessary safety investigations and risk analysis.

It should be noted that the information obtained from the controlled object is not processed by the Remotus receiver, but is used for informational purposes.

For the reasons stated above, the safety of Remotus covers mainly the status of the relay outputs, regardless of the object that is controlled by the relays.

The interface between Remotus and the controlled object should be a special interface that is not included in Remotus system and therefore is not included in this installation manual.

The approvals for Remotus refer only to the Remotus system not the complete system.

The complete radio control system must be tested and approved in accordance with applicable standards. It is not part of Åkerströms Björbos responsibility.

# 2 Scope

The Remotus Jupiter system described in this manual consists of one receiver and one transmitter.

| | Type | Model | Symbols |
|---|---|---|---|
| Receiver | RX160 | J-RX160 | |
| Button transmitter | AQ80 | Jupiter Era 4B<br>Jupiter Era 6B<br>Jupiter Era 8B | Nordic, DIN, CS or numbers |

# 3 Use of warnings and notes in this manual

**Read all safety instructions throughout this manual and on safety signs attached to this equipment.**

Failure to follow all safety instructions could result in death or serious injury.
The safety alert symbol is used to alert about potential personal injury hazards. To avoid hazards, obey all safety messages that follow this symbol. Inform all personnel that are working with the product.
The following safety alert symbols and signal words are used in this manual to inform the user of hazards.

Indicates a potentially risk of high voltage which, if not avoided, could result in death or serious injury or property damage.

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury or property damage.



Indicates a condition which, if not avoided, could result in damage to or poor functionality of the product.

Electrostatic sensitive devices warning tells you about the risk of electrostatic discharge which can cause damage to the product.

# 4 Warnings regarding installation and maintenance work

**This manual must be read and understood before installing and starting the radio remote control system to ensure safe and secure operation.**

**The installation and/or maintenance work must be carried out by a qualified and educated person in accordance with country installation rules and regulations. Only a correct installation can ensure the necessary level of safety during use.**

**The equipment can be supplied by different energy sources e.g. for the relay contacts or the regular power supply of the equipment!**

**Before starting ANY maintenance work ensure by using the external separators / fuses of the permanent installation, that ALL terminal blocks are free from dangerous voltage!**

**CAUTION DOUBLE POLE/NEUTRAL FUSING**

**Risk of high noise level, hearing protection required**

**If a siren is mounted on the receiver unplug it before any maintenance action. Put it back when the maintenance is done.**

# 5 Specifications

| | | | |
|---|---|---|---|
| **General:** | | | |
| Operating frequency: | 863-870 MHz | *915-928 MHz* | *433-434 MHz* |
| Power output: | < 5 mW | *< 3 mW AUS/NZ* | *< 10 mW* |
| Baud rate: | 9600b/s | *9600 b/s* | *9600 b/s* |
| Transmission principle: | GFSK, TDMA | GFSK, TDMA | GFSK, TDMA |
| Channel Separation: | 25 kHz | 25 kHz | 25 kHz |
| Functional sensitivity: | ≤-107 dBm BER $10^{-3}$ | ≤-107 dBm BER $10^{-3}$ | ≤-107 dBm BER $10^{-3}$ |
| The radio full-fills: | R&TTE Directive 99/5EC | | |
| Reaction time on STOP function: | Maximum 550 ms | | |
| Safety category for the Stop function | ISO 13849-1 Category 3 PL d | | |
| Safety category for unintended movement (UMFS) | ISO 13849-1 Category 3 PL d, possible to achieve with Era 8B. | | |
| **Receiver RX160:** | | | |
| 16 Relay outputs:<br>• 6 safety relays (NO) for movements<br>• 4 change-over relays (NO/NC)<br>• 6 normally open relays (NO) | | | |
| 2 Separate main contactor change over safety relays | | | |
| 1 Digital output for horn (siren) | 12V | | |
| 1 Analogue input: | 0 (4) -20 mA or 0(2)-10 V | | |
| 2 Digital inputs: | 24/48 V AC/DC (Opto-isolated) or 115/230 V AC (Opto-isolated) | | |
| 1 Serial port: | RS422/RS485 | | |
| Input voltage: | 24/48/115/230 V AC, power consumption less than 14 VA<br>or 24 V DC 0.5 A. Shall be connected to SELV circuits. | | |
| Dimensions: | 277x217x115 mm | | |
| Weight: | Approximately 1.6 kg | | |
| Operating temperature: | -25 °C – +55 °C | | |
| Storage temperature: | -40 °C – +85 °C | | |
| **Transmitter AQ80:** | | | |
| Dimensions: | 181 x 65 x 43 mm | | |
| Weight: | 265 g | | |
| Operating Temperature for battery: | -20 °C – +55 °C | | |
| Storage Temperature for battery: | -20 °C – +35 °C | | |
| Charging Temperature for battery: | +10 °C – +45 °C<br>NOTE! For charging see charger documentation | | |
| External power supply voltage: | 5 ± 0.25V 100mA max.<br>Must be supplied with Limited Power Source (LPS) | | |
| Display: | Graphic LCD, 128x64 pixels | | |

*Table 1. Technical specifications*

## *5.1 Design*

The RX160 receiver consists of a MAIN board, antenna board and a radio module. The radio module is located on top of the MAIN board.

The MAIN board holds all logic components, relays, power supply and the connectors.

The enclosure is made of fire resistant UL 94-5V plastic.

## 5.2 Functional description

The Remotus Jupiter Era system uses a dual channel architecture in both the receiver and the transmitter to achieve high degree of safety. For additional safety the receiver RX160 is equipped with eight (8) safety relays whereof two safety relays are intended for safety stop. The other 6 safety relays are used for crane movement and provides protection against unintended movement due to welded relay contacts (UMFS Category 3 PL d ISO 13849-1:2006).

The dual channel architecture and extensive use of safety relays in the receiver will significantly increase the safety of the crane system providing that the installation is carried out correctly. To achieve category 3 Pl d for the STOP function according to ISO 13849-1:2006 both safety stop outputs from the receiver shall be connected to two independent stop inputs on the crane (two safety stop channels).

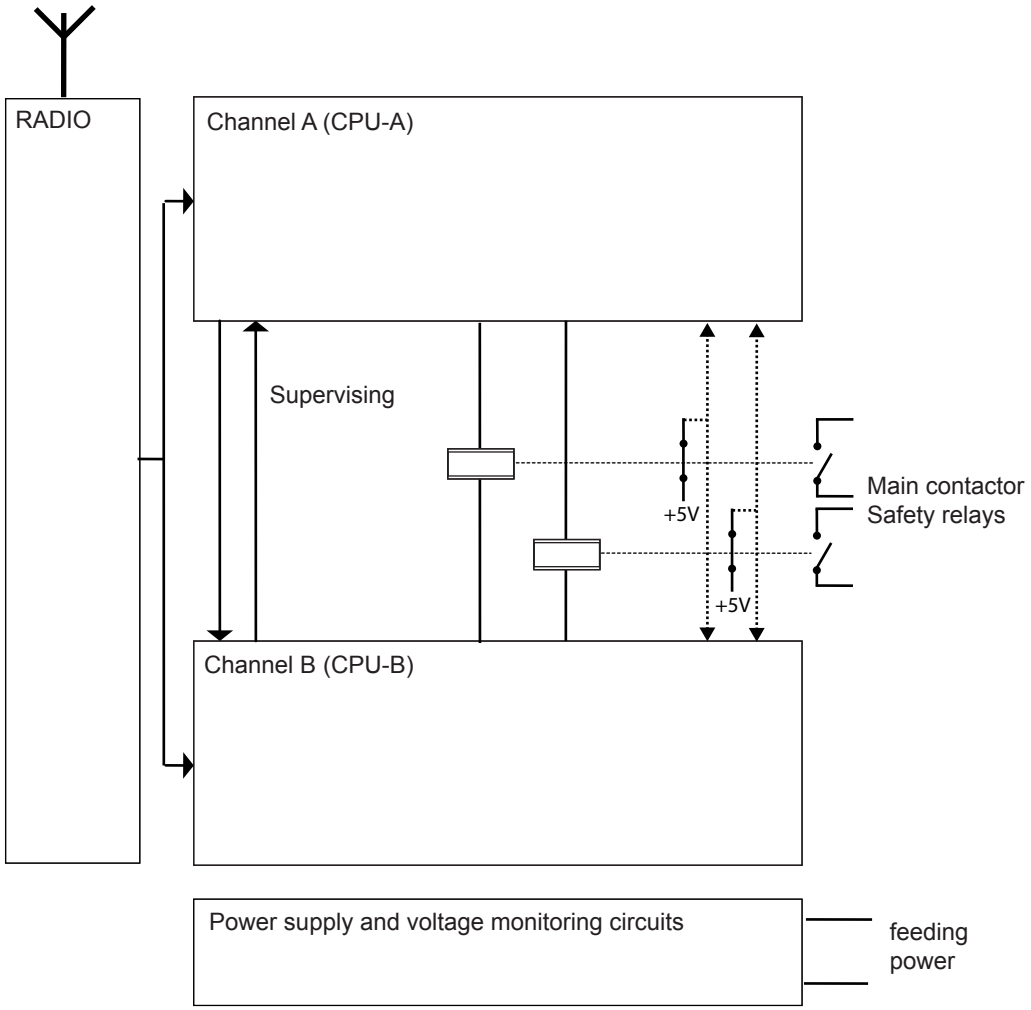



*Figure 1. Receiver functional safety description*

# 6 Installation

The permanent installation of the receiver must include fuses to protect the equipment and wiring from over current and short circuit. In detail the power supply of the receiver and all relay contacts must be fused.

All fuses are used as disconnecting devices. The fuses shall be easily accessible, must submit a contact-gap of at least 3.0 mm and have to be placed in the line pole (L). NOTE! The neutral line fuse on the PCBA is NOT sufficient as a disconnecting device. After removal of the fuse, parts of the equipment will remain energized and might represent a hazard during servicing.

## 6.1 *Mechanical installation*

Note! Make sure to install any optional accessories inside and/or on the receiver enclosure before mounting the receiver on the crane. Refer to each accessory kit for assembly instructions.

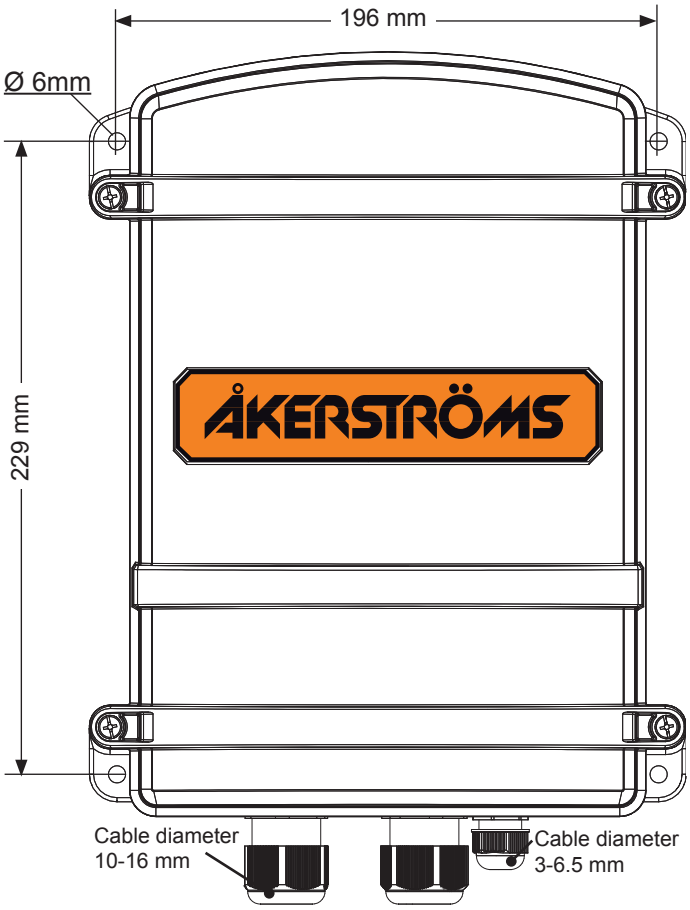
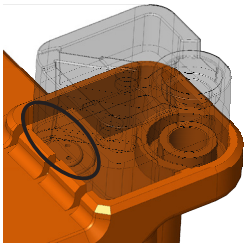



*Figure 2. Mount RX160*

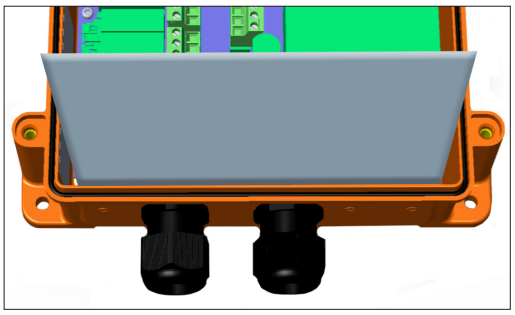
Mount the receiver upright with the cable glands facing down. The receiver shall be mounted on a flat surface with screws suitable for the surrounding environment. Note! If the plastic spacer is mounted the screws needs to be 20 mm longer.

**Assembly Instruction - plastic spacer (optional)**

Press the plastic spacers firmly to the bottom enclosure. Make sure to align the spacers frame opening with the condensation filter ventilation on the bottom enclosure lower, right side.
4 black plastic spacer art. no: 947504-000.



When drilling the hole for the cable gland, make sure not to damage the printed circuit board or the transformer inside. Place some protection inside the enclosure to stop the drill from damaging the interior.



## 6.2 Connections and switches on the MAIN board

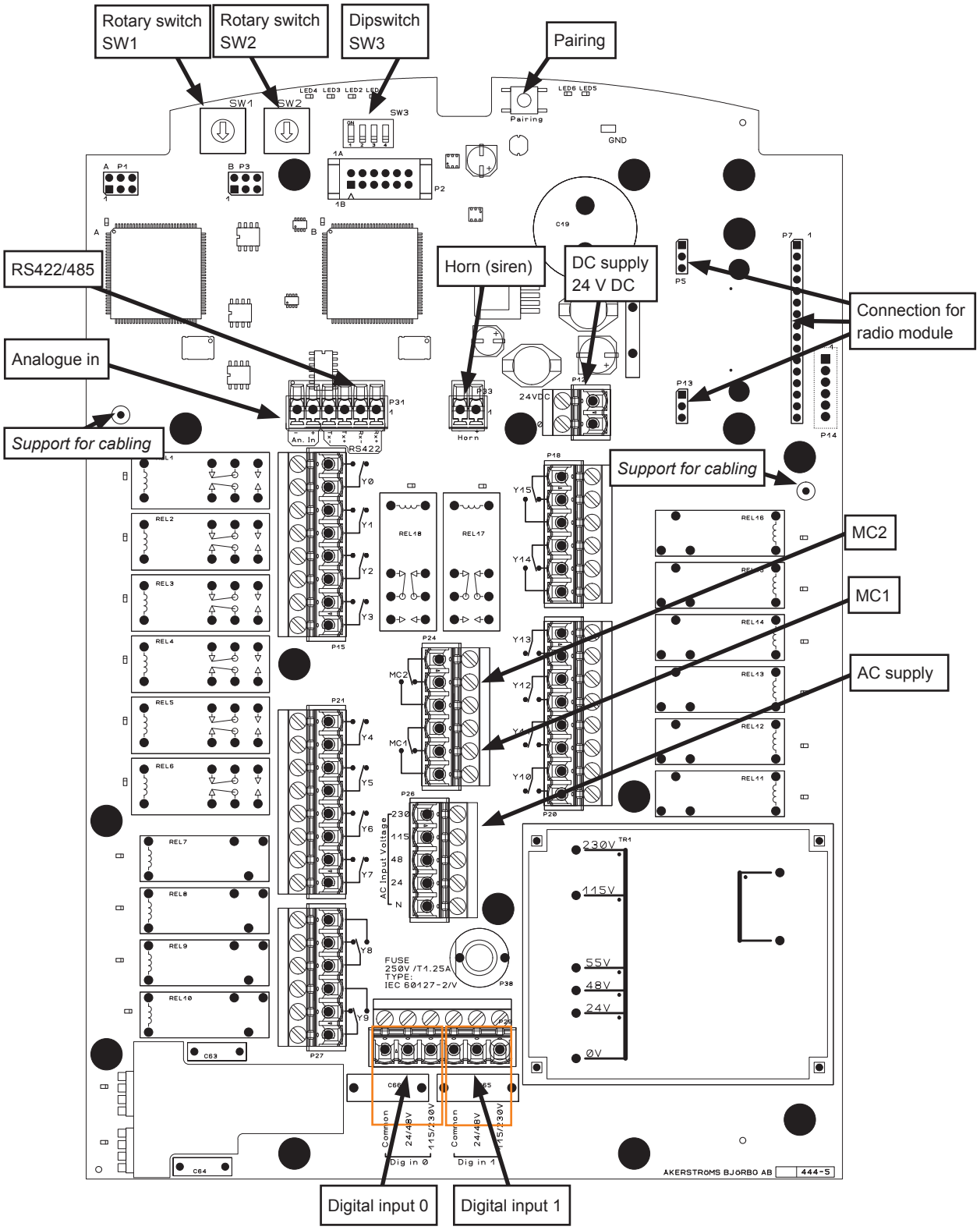



*Figure 3. Connections and switches on the MAIN board*

## 6.3 Cable installation

**If the receiver and/or receiver terminals are connected to more than one line phase the voltage between any connector must NOT exceed 250 V.**
**If voltage of one phase is 230 V AC the corresponding three phase voltage is 380 V AC and thus NOT allowed.**

**Max loading by relay may not be over 2 A.**

**Current loops containing relay contacts SHALL therefore have a protection fuse not higher rated than 6 A.**
**A protection fuse for the receiver main supply shall be rated 6 A.**

**Do not mix SELV and NON SELV signals in the same cable.**

**After the installation of the equipment, the installed cables must be bound together in pairs (e.g. by using a cable tie) very close to the terminal blocks (see Figure 4). This is important if a cable become loose. The cable should not be able to end up in an unsuitable location of the receiver.**

**Fasten with a torque of 0.4-0.5 Nm.**

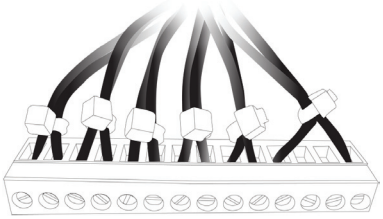
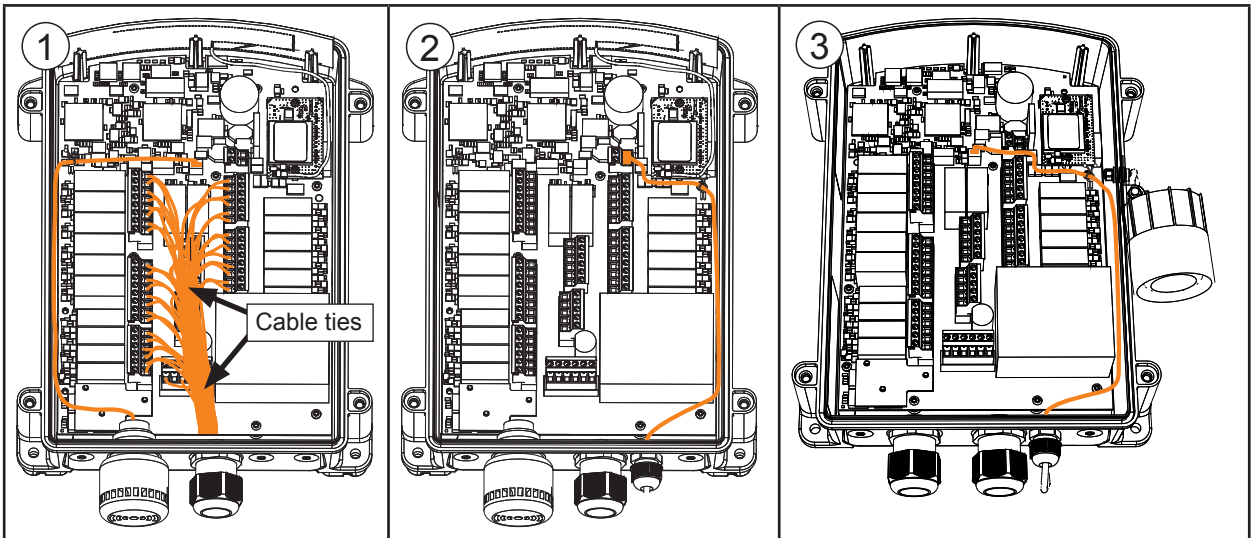


*Figure 4. Installation of cables*

### Cabling




| |
|---|
| Note! The position of different cable glands can vary depending on combination of accessories. |
| ① **Relay/digital in and hole mounted siren cabling**. Note! Relay cabling, use cable ties not only as in Figure 4 but also to hold them together in the middle. Hole mounted siren cabling to the left. |
| ② **DC supply cabling.** Note! The connection from this supply shall be routed through its own cable gland. |
| ③ **External siren** |
| **RS 422/485 and Analogue in.** M12 cable gland at suitable placement. Note! Cabling shall be routed to the left or right. |
| **Pigtail for external antenna.** BNC chassis connector in the rightmost hole. Note! Cabling shall be routed as shown in ② / ③ |

For relay terminal and connector number see Figure 3 on page 10.

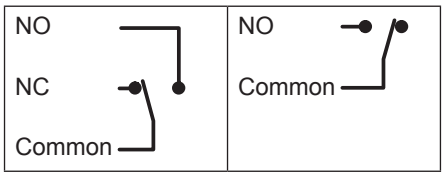



*Figure 5. Relay symbol explanation*

### 6.3.1 Functional diagram

The receiver functional diagram shows how to connect the equipment, in this manual the functional diagram is written as different program options, see chapter 11.

### 6.3.2 Principle connection of the Main contactors

The radio remote control system is, for the safety stop function, designed for category 3 Pl d according to ISO 13849-1:2006. To achieve this safety level for the object (crane) both safety stop outputs MC1 and MC2 shall be used as two separate independent outputs (two safety channels). This means that there must be two main contactors on the machine. See the connection example below.

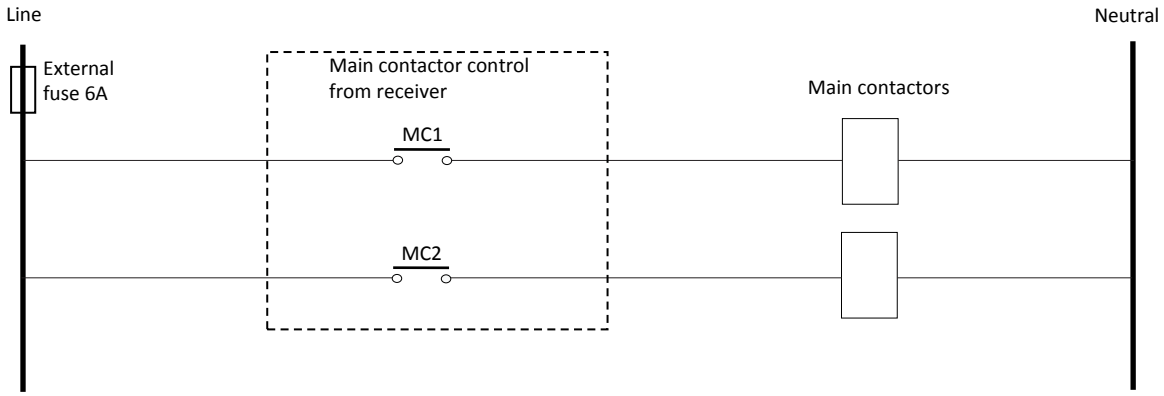



*Figure 6. Connection with the two main contactors in parallel, **category 3***

If category 3 is not desired, the two safety stop outputs MC1 and MC2 shall be used connected in series. See the connection example below. The maximum level of safety for the safety stop function in this case will be category 1.

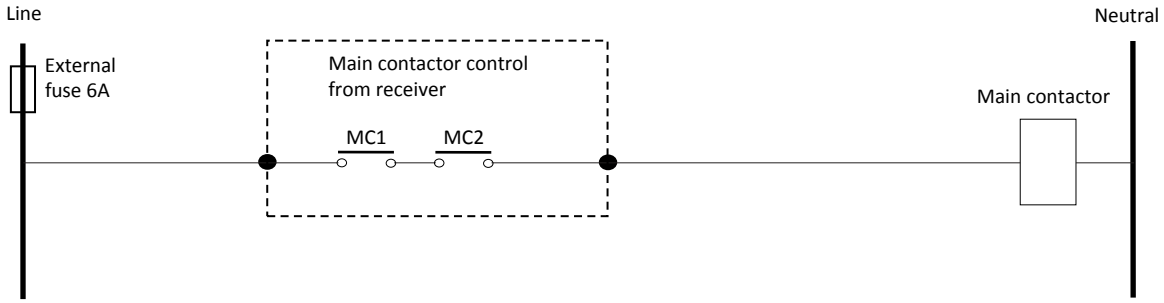
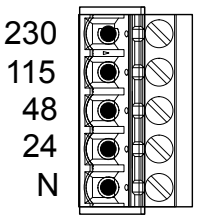



*Figure 7. Connection with the two main contactors in series, **category 1***

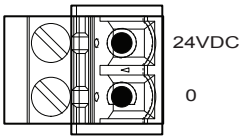
### 6.3.3 AC supply

Carefully check the power supply voltage level.



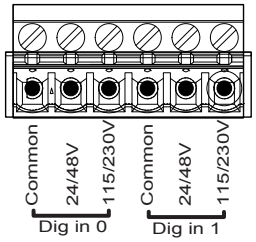

### 6.3.4 DC supply

The connection cable for the DC supply shall be routed through its own cable gland.
Do not mix with NON SELV signals.




### 6.3.5 Digital inputs

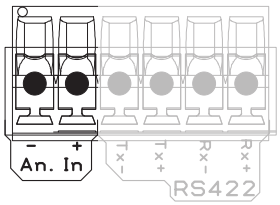
Carefully check the signal voltage level.
These two signals appear as symbols on the transmitter display.




### 6.3.6 Analogue input

This signal may be used for weight information from a scale, shown on the transmitter's display. See section 9.2.2.

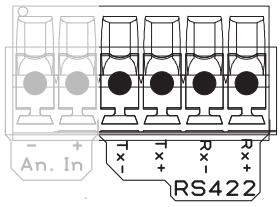
Do not mix with NON SELV signals.




### 6.3.7 RS422/485

This signal may be used for weight information from a scale, shown on the transmitter's display. See section 9.2.2.

Do not mix with NON SELV signals.




### 6.3.8 Connection cable

The cable cross-sectional area shall be at least 0.75 mm² and with an outer insulation diameter of 10-16 mm.

## 6.4 *Antenna placement*

The antenna is by default placed internally in Jupiter RX160.

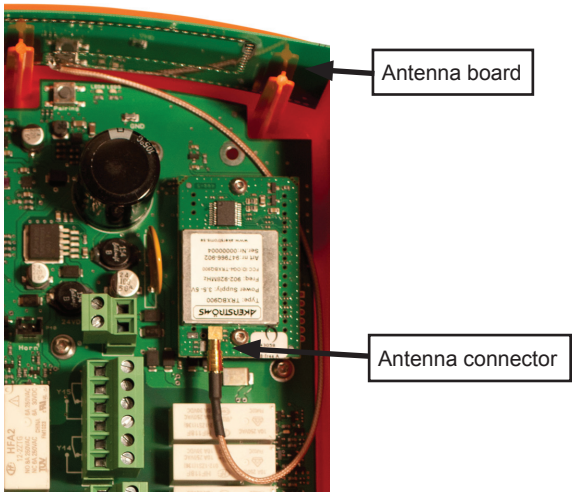



*Figure 8. Internal antenna*

### 6.4.1 In case of external antenna placement

When mounting the antenna separately it must be placed as open (in free air) as possible preferably below the crane beam.

A covered antenna contributes to a considerably less effective radio reception. An antenna can not be mounted in a cabinet.

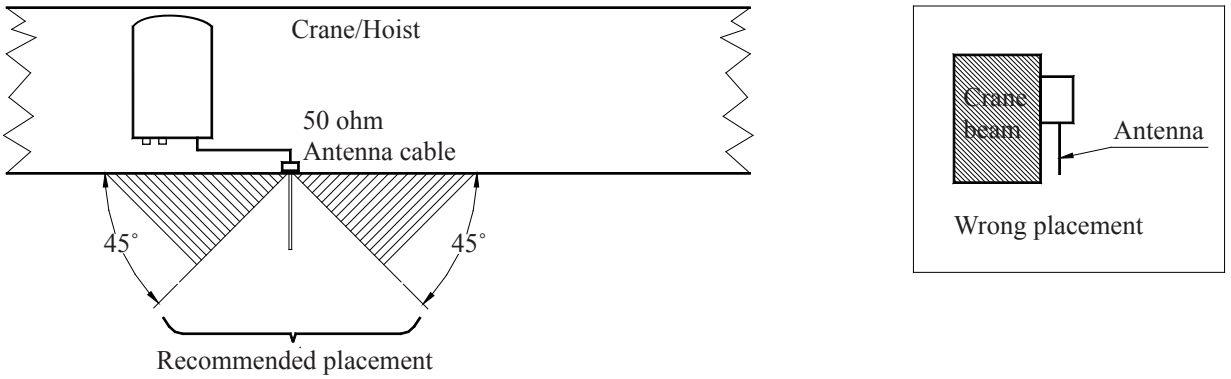



*Figure 9. Recommended and wrong placement of the antenna*

**! The antenna must never come into contact with metal parts.**

**If the antenna is installed outdoors, there is a risk of dangerous voltages entering the antenna cable. To minimize this risk a DC block shall be used. DC blocks are coaxial components that prevent the flow of low and direct current (DC) frequencies while offering minimum interference to RF signals. Suitable models have capacitors in series with both the inner and outer conductors.**

**Åkerströms can provide one suitable DC block 944498-000.**

# 7 Commissioning

## 7.1 *Frequency setting*

The radio transmission used in the Jupiter systems can use either a frequency hopping transmission scheme or scan mode were frequency are automatically selected. The default factory setting is frequency hopping which is recommended for most applications.

Note! The transmitter and receiver must have the same frequency setting.

**Frequency hopping**
Frequency band 800 uses LBT+AFA frequency hopping transmission.
Frequency band 900 and 400 uses frequency hopping transmission.

| | |
|---|---|
| **AFA** - Adaptive Frequency Agility | capability of an equipment to dynamically change the temporary operational channel within its available frequencies for proper operation. |
| **LBT** - Listen Before Talk | capability of an equipment to disable transmission on a specific radio channel if the channel is busy. |

When frequency hopping is selected, the frequency changes automatically between 15 different frequencies in the frequency-band.

**Scan mode**
**Scan free frequency**
Scan free frequency scheme automatically scans between 15 different frequencies and one frequency in the frequency-band will be used. The transmitter changes to a free frequency every time it´s started, as long as the transmitter searches for a free frequency the status indicator glows yellow.

**Fixed frequency**
Fixed frequency channel set by the user. For Receiver setting refer to RX160 configuration tool and for transmitter, see chapter 7.2.3.

### 7.1.1 Radio frequency setting in Receiver RX160

Before changes of the frequency setting, disconnect the power.

The SW3 dipswitch for adjusting frequency setting is marked in Figure 3. See Figure 10 for settings.
If switch 2 is set to:

**OFF:** Frequency hopping

**ON:** Scan mode, automatically selected frequency also fixed frequency

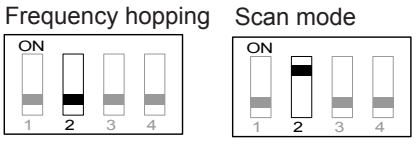



*Figure 10. Adjust the frequency setting, switch 2*

The receiver RX160 normally uses frequency hopping for radio communication. By watching the indications “Squelch” (LED 4) and “Message received” (LED 3) it is possible to diagnose the quality of the radio channel (see section 9.1 on page 29).

- Every time a message is received the indication “Squelch” lit. The messages are sent at a constant rate. The indication “Squelch” shall lit at this rate. If this isn’t the case some of the channels can be occupied or some of the used frequencies (1 of 15) are not working.
- If the message is accepted by the receiver, indication “Message received” will lit.

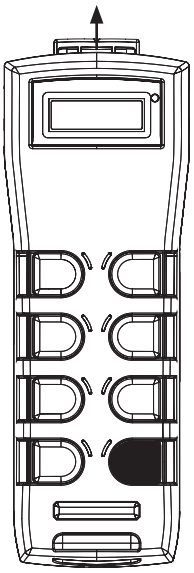
If the indication “Message received” does not lit at the same rate as the indication “Squelch” the messages on one or more frequencies are disturbed or distorted.

**Note!** The transmitter has to be set to the same frequency setting, see section 7.2.3 on page 18.

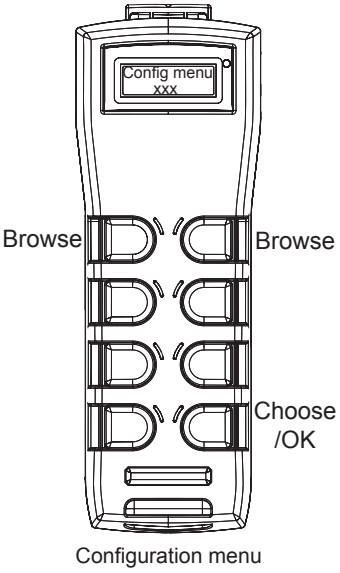
## 7.2 *Transmitter configuration mode*

### Enter configuration menu

Press button B8 (2nd step) while pulling up the safety stop button. Hold down the button 3 seconds until the status indicator glows yellow showing that the transmitter is in configuration mode.



Enter config menu




Configuration menu

### Submenu

Browse submenu with the buttons B1 and B2. Choose submenu with button B8. To return to the main menu while you are in a submenu, press button B7.

Submenus:

- "Shutdown"
- "PIN-code"
- "Frequency"
  - "433 MHz"
- "Button function"
- "Radio comm power"
- "FX sequence"
- "Remote type"
- "Heavy weight PIN-code"
- "System info"

### Exit/Save

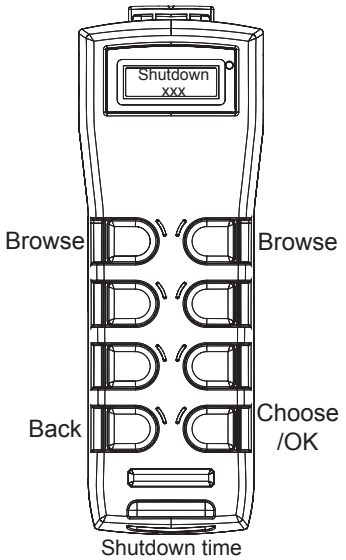
Finish by turning the transmitter off by pushing the safety stop button down. This also saves the changes that have been made.

## 7.2.1 Shutdown Time of the Transmitter

The transmitter shuts down automatically if not used for a certain amount of time. This time can be adjusted in the transmitter configuration menu.

1. Enter the configuration menu.
2. Then select "Shutdown" with B8 (browse with B1 and B2).
3. Then browse the desired shutdown time with B1 and B2:
   - "2 minutes"
   - "5 minutes"
   - "15 minutes"
   - "no shutdown"

   Already selected shutdown time is indicated by button LED B1.
4. Select shutdown time by press down button B8.
5. Automatic return to the main menu or restart the transmitter.

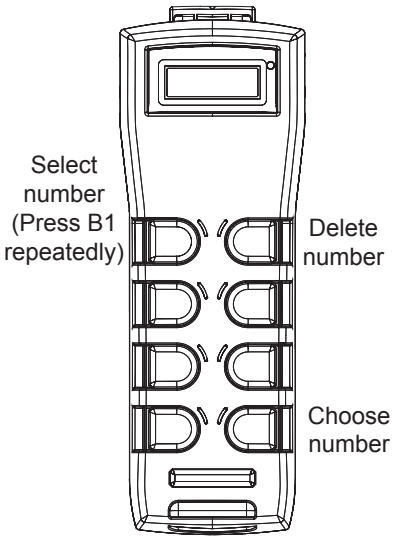



Shutdown time

### 7.2.2 PIN-code Configuration of the Transmitter

The transmitter is equipped with a user configurable PIN-lock to prevent unauthorized access to the system. The PIN-lock is disabled by default.

1. Enter the configuration menu.
2. Then select “PIN-code” with B8 (browse with B1 and B2).
3. Enter PIN:
   For **enable** enter the factory setting 3333 and
   for **disable** enter the old PIN-code.
   Press B1 repeatedly to select number and B8 to choose the number. Delete a number with B2.
4. Enter new PIN:
   Enter the new 4-digit PIN.
   For **enable** enter the new PIN (not 3333) and
   for **disable** enter the factory setting 3333.
5. Repeat PIN:
   Repeat the PIN code.
6. Automatic return to the main menu or restart the transmitter.



PIN code Enable/Disable

#### 7.2.2.1 Entering PIN-code at start-up

When PIN is enabled the transmitter will not start to transmit before the correct PIN-code is entered. If the transmitter is PIN locked at startup status indicator shows red continuous light. Display will show “Enter PIN”.

Enter the 4-digit PIN-code by press B1 repeatedly to select number and B8 to choose the number. Delete a number with B2. When all 4-digit are selected, press B8 once again to select the PIN code.

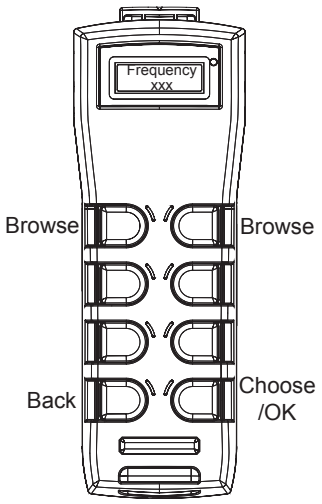
At successful login the status indicator shows green flashing. Display shows “PIN OK!”. The unit is now in operating mode.

### 7.2.3 Radio Frequency Setting in the Transmitter

To change the settings do the following:

1. Enter the configuration menu.
2. Then select “Frequency” with B8 (browse with B1 and B2).
3. Then browse to the desired setting with B1 and B2.
   - “Frequency hopping”
   - “Scan mode”
   - “Channel 0-XX”

   Already selected setting is shown when entering the frequency setting menu.
4. Select setting by press down button B8.
5. Automatic return to the main menu or restart the transmitter.



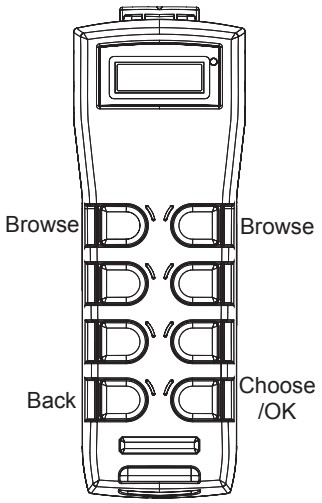

- **Frequency hopping:** When frequency hopping is selected, the frequency changes automatically between different frequencies in the frequency-band.
- **Scan Mode:** Automatically scans between different frequencies and one frequency in the frequency-band will be used. The transmitter changes to a free frequency every time it´s started, the scan will start at the same frequency that was used last time the transmitter was started.
- **Channel:** Sets a specific channel.
  See “7.2.3.2 Fixed frequency” on page 19.

#### 7.2.3.1 433 MHz (only frequency band 400)

In frequency band 400 there is an opportunity to select region.

1. Enter the configuration menu.
2. Then select “433 MHz” with B8 (browse with B1 and B2).
3. Then browse to the desired setting with B1 and B2.
   - “EU”
   - “Other”

   Already selected setting is indicated by button LED B1.
4. Select setting by press down button B8.
5. Automatic return to the main menu or restart the transmitter.




**! Note. If the equipment is being operated in EU-region this setting has to be set to EU for correct fulfill the regulation! See “Appendix 1 - European Radio Regulation” on page 45.**

**! For Other make sure to fulfill any rules or regulations or any applicable local, state, or federal governing laws.**

### 7.2.3.2 Fixed frequency

| Channel no | 869MHz | 434MHz EU | 433-434MHz Extended |
|---|---|---|---|
| 0 | 869,7125 | 434,05 | 433,3 |
| 1 | 869,7375 | 434,075 | 433,325 |
| 2 | 869,7625 | 434,1 | 433,35 |
| 3 | 869,7875 | 434,125 | 433,375 |
| 4 | 869,8125 | 434,15 | 433,4 |
| 5 | 869,8375 | 434,175 | 433,425 |
| 6 | 869,8625 | 434,2 | 433,45 |
| 7 | 869,8875 | 434,225 | 433,475 |
| 8 | 869,9125 | 434,25 | 433,5 |
| 9 | 869,9375 | 434,275 | 433,525 |
| 10 | 869,9625 | 434,3 | 433,55 |
| 11 | 869,9875 | 434,325 | 433,575 |
| 12 | | 434,35 | 433,6 |
| 13 | | 434,375 | 433,625 |
| 14 | | 434,4 | 433,65 |
| 15 | | 434,425 | 433,675 |
| 16 | | 434,45 | 433,7 |
| 17 | | 434,475 | 433,725 |
| 18 | | 434,5 | 433,75 |
| 19 | | 434,525 | 433,775 |
| 20 | | 434,55 | 433,8 |
| 21 | | 434,575 | 433,825 |
| 22 | | 434,6 | 433,85 |
| 23 | | 434,625 | 433,875 |
| 24 | | 434,65 | 433,9 |
| 25 | | 434,675 | 433,925 |
| 26 | | 434,7 | 433,95 |
| 27 | | 434,725 | 433,975 |
| 28 | | 434,75 | 434 |
| 29 | | 434,775 | 434,025 |
| 30 | | | 434,05 |
| 31 | | | 434,075 |
| 32 | | | 434,1 |
| 33 | | | 434,125 |
| 34 | | | 434,15 |
| 35 | | | 434,175 |
| 36 | | | 434,2 |
| 37 | | | 434,225 |
| 38 | | | 434,25 |
| 39 | | | 434,275 |
| 40 | | | 434,3 |
| 41 | | | 434,325 |
| 42 | | | 434,35 |
| 43 | | | 434,375 |
| 44 | | | 434,4 |
| 45 | | | 434,425 |
| 46 | | | 434,45 |
| 47 | | | 434,475 |
| 48 | | | 434,5 |
| 49 | | | 434,525 |
| 50 | | | 434,55 |
| 51 | | | 434,575 |
| 52 | | | 434,6 |
| 53 | | | 434,625 |
| 54 | | | 434,65 |
| 55 | | | 434,675 |
| 56 | | | 434,7 |
| 57 | | | 434,725 |
| 58 | | | 434,75 |
| 59 | | | 434,775 |

**Note!** Fixed frequency only applied on system version 1.20 or later. See system version on the display at start up of the transmitter.

*Table 2. Fixed frequency list*

### 7.2.4 Adjustment of the Push Buttons Remaining and Momentary Functions

The buttons either have momentary functions, which give a signal for only as long as you keep pressing, or remaining functions.

**Note that this function needs support from the receiver PLC. Before changing these parameters, check the program options. Only qualified personnel may make these changes.**

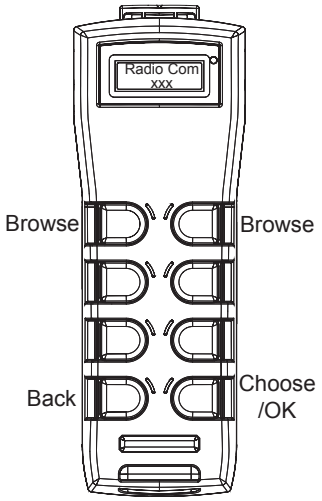
1. Enter the configuration menu.
2. Then select “Button function” with B8 (browse with B1 and B2).
3. Press down the buttons for which you want to have a remaining/momentary function. Lighted button LED indicates remaining function. **Note:** The three pair of buttons 1-2, 3-4 and 5-6 must have the same settings within the pair. Otherwise the momentary function is disabled on the button that is not remaining.
4. Restart the transmitter.

### 7.2.5 Radio communication power

To change the settings do the following:

1. Enter the configuration menu.
2. Then select “Radio comm power” with B8 (browse with B1 and B2).
3. Then browse to the desired setting with B1 and B2.
   - “Auto power”
   - “100 % power”
   - “25 % power”

   Already selected setting is indicated by button LED B1.
4. Select setting by press down button B8.
5. Automatic return to the main menu or restart the transmitter.

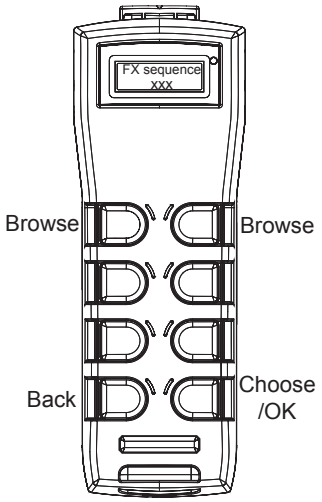



### 7.2.6 FX sequence

To change the settings do the following:

1. Enter the configuration menu.
2. Then select “FX sequence” with B8 (browse with B1 and B2).
3. Then browse to the desired setting with B1 and B2.
   - “255 X:XX Disabled”
   - “000 0:0 - 119 7:14”

   Already selected setting is the first one that comes up when entering the menu.
4. Select setting by press down button B8.
5. Automatic return to the main menu or restart the transmitter.



## 7.2.7 Remote type (only Era 8B)

The Jupiter Era 8B transmitter can be set to 8/9 or 10 Buttons. For 9 and 10 more functions can be admitted with a SHIFT-function (B8 2nd step).

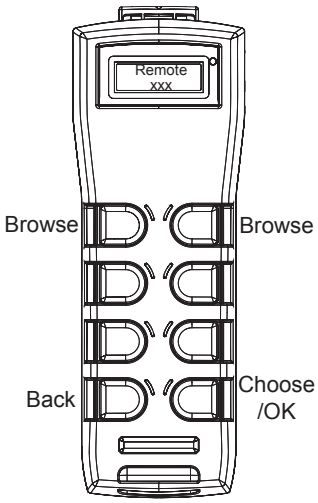
**! NOTE! The functionality of the transmitter is depending on this setting. This setting also alters the placement and symbols on the transmitter, see section 12.1.**

| | |
|---|---|
| **8 Buttons** | Era 8B standard |
| **9 Buttons** | Standard + selection of 1&2 and A&B functions |
| **10 Buttons** | Standard + selection of 1&2 functions |

To change the settings do the following:

1. Enter the configuration menu.
2. Then select “Remote type” with B8 (browse with B1 and B2).
3. Enter PIN-code (see to box to the right).
   Press B1 repeatedly to select number and B8 to choose the number.
   Delete a number with B2.
4. Then browse to the desired setting with B1 and B2.
   - “8 BUTTONS”
   - “9 BUTTONS”
   - “10 BUTTONS”

   Already selected setting is indicated by button LED B1.
5. Select setting by press down button B8.
6. Automatic return to the main menu or restart the transmitter.




**PIN-code:**
Go to system info (see 7.2.9). ID=XXXXX:YY Z/Z take the first five numbers (X). This is the PIN-code. If there only are four numbers enter a 0 before them 0XXXX.

## 7.2.8 Heavy weight PIN-code

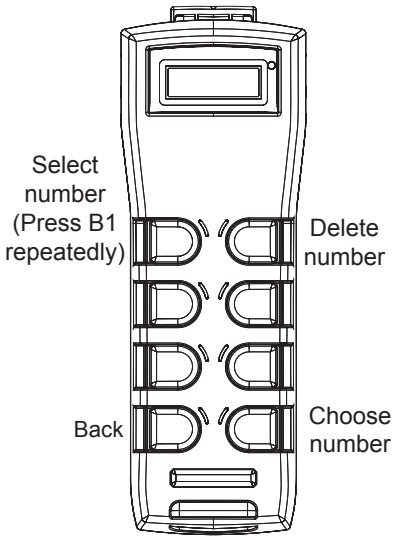
The transmitter is equipped with a user configurable heavy weight PIN-lock to prevent unauthorized access to heavy weight lift. The heavy weight PIN-code is disabled by default.

**Enable Heavy weight PIN code:**

1. Enter the configuration menu.
2. Then select “Heavy weight PIN code” with B8 (browse with B1 and B2).
3. Enter PIN:
   Enter the four last numbers of the CIM ID.
4. Enter new PIN:
   Enter the new 4-digit PIN (not same as the four last in CIM ID).
5. Repeat PIN:
   Repeat the PIN-code.
6. Automatic return to the main menu or restart the transmitter.

**Disable Heavy weight PIN code:**

1. Enter the configuration menu.
2. Then select “Heavy weight PIN code” with B8 (browse with B1 and B2).
3. Enter PIN:
   Enter the old PIN-code.
4. Enter new PIN:
   Enter the four last number of the CIM ID.
5. Repeat PIN:
   Repeat the PIN-code (four last number of the CIM ID).
6. Automatic return to the main menu or restart the transmitter.



PIN code Enable/Disable

**PIN-code (CIM ID):**
Go to system info (see 7.2.9). ID=XXXXX:YY Z/Z take the four last numbers (X). This is the PIN-code.

**Note!** Heavy weight PIN-code only applied on system version 1.20 or later. See system version on the display at start up of the transmitter.

### 7.2.8.1 Enter and activate heavy weight PIN during operation

When heavy weight PIN is enabled the system will not lift heavy weight (over 5-ton) before the correct heavy weight PIN code is entered.

1. Press and hold down the button B7 (step 2) for more than 3 seconds. This will activate the heavy weight PIN-code entry mode.
2. Enter the 4-digit heavy weight PIN-code by press B1 repeatedly to select number and B8 to choose the number. Delete a number with B2.
3. After the four digits have been entered the transmitter returns to normal operation mode. If the correct 4-digit PIN code is entered, button LED 7 will light and the remaining function for button B7 will continue to be active (heavy weight activated).

### 7.2.8.2 Deactivate heavy weight during operation

Press and hold down the button B7 (step 2) for more than 3 seconds until button LED B7 goes out.

## 7.2.9 System info

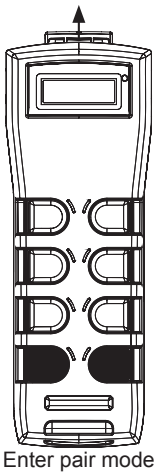
Shows firmware version for the CIM card, ID number and package rate.
Press any of the two bottom buttons for exit this menu.

## 7.3 Pairing of transmitter and receiver

Open the lid on the receiver. Indications LED 5&6 (see Figure 13) and the pairing push button (see Figure 3) on the MAIN board should be used when pairing the receiver and transmitter.

1. Press the pairing button in the receiver.
2. Set the transmitter in pairing mode.
   Hold down button B7 and B8 when starting the transmitter. Continue to press the buttons for ≈5 seconds.
3. See pairing indications, next section. When paired LED 5 shows steady green. If this hasn't been indicated within 15 seconds restart the transmitter.
4. Restart the system to activate the new ID number.

The receiver has now learned the transmitter ID number and will only accept commands from that transmitter.


Enter pair mode

### 7.3.1 Pair a second ID (for tandem/multi-operator operation)

See section "7.5 Tandem and Multi-operator Operation" on page 24.

### 7.3.2 Pairing indications

| Mode | Event | LED indication Receiver | Flash rate | Pairing button LED 6 LED 5 LED6 LED5 |
|---|---|---|---|---|
| **Pairing** | In pairing mode | LED 6 fast<br>LED 5 steady | 50/50 ms | |
| | Paired | LED 5 steady | | |

*Table 3. Receiver pairing indication*

| Mode | Event | Status indicator transmitter | Flash rate |
|---|---|---|---|
| In pairing mode | Not paired | Green/yellow | 50/50 ms |
| | Paired | Steady green | |

*Table 4. Transmitter pairing indication*

| Pairing: | Pairing ready: | Link timeout: |
|---|---|---|
| Pair mode<br>Pairing... | Pair mode<br>Paired!<br>↓<br>Restart<br>System! | Pair mode<br>Failed!<br>↓<br>Restart<br>Pair mode! |

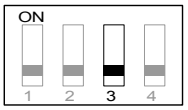
*Table 5. Transmitter display pairing indication*

## 7.4 Micro (slow speed) Operation

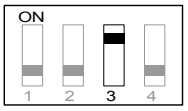
The SW3 dipswitch for adjusting micro setting is marked in Figure 3. See Figure 11 for settings.

**Non simultaneous - SW3:3 OFF**
The buttons/joysticks for movement are interlocked during this time so that only one movement can be operated at a time.

**Simultaneous - SW3:3 ON**
The buttons/joysticks for movements are looped so that two or more movements can be operated simultaneously.



Non simultaneous



Simultaneous

*Figure 11. Micro operation setting, switch 3*

**Note! Micro operation is not possible with Era 8B "9 Buttons".**

**Note! For Era 8B "10 Buttons" B8 1st step (micro) needs to be pressed down 0.3 seconds for activation of micro function.**

## 7.5 Tandem and Multi-operator Operation

**Only transmitter 8B set to 9 or 10 Buttons (see section 7.2.7).**

**It is strongly recommended to use scan free frequency setting for any of the tandem/multi operator modes. This will significantly increase the speed of the radio synchronization during crane selection.**

### Tandem Operation

Tandem operation means that two cranes can be operated from the same transmitter, which makes it easier, for example to lift two objects simultaneously or a big object using two cranes.

A data link is needed between the two cranes. This link shall fulfil at least EN ISO 13849-1:2008 Performance Level c and category 2.

### Multi-operator Operation

Multi-operator operation means that two transmitters can operate the same object. This can be beneficial, for example, when the view is blocked. The control of the object can be passed between two transmitters. Active crane selection and deselection guarantees that only one transmitter is in control of the object at a time.

### Pairing

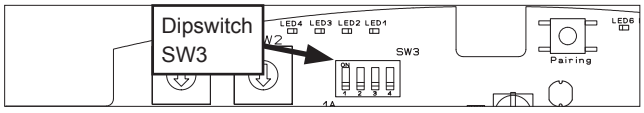



*Figure 12. Dipswitch SW3, position in the receiver*

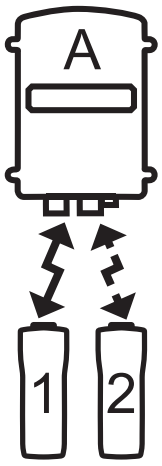
Follow the pairing instruction described in section 7.3, but notice the difference of SW3 when pairing the different transmitters and receivers. For settings of dipswitch SW3 see respective section.

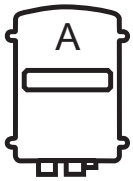
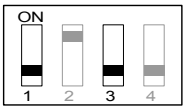
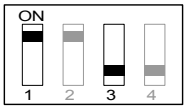
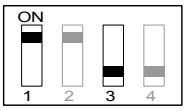
## 7.5.1 Multi-operator operation

### 2 transmitters and 1 receiver

In order to run multi-operator operation the receiver must be paired with two ID's. First paired transmitter = transmitter 1.

1. Pair transmitter 1 to the receiver. Disconnect and reconnect the power source to the receiver.
2. Pair transmitter 2 to the receiver. Disconnect the power source to the receiver, set the SW3 in "during operation" and reconnect the power source to the receiver



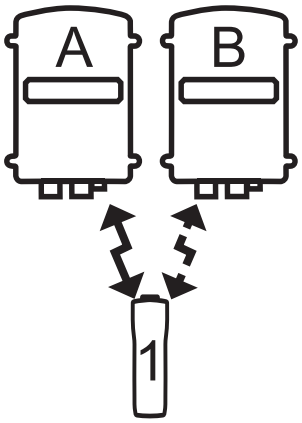

| | | During pairing | During operation |
|---|---|---|---|
| Receiver A   | Transmitter 1 |   SW3:1 OFF, SW3:3 OFF |   SW3:1 ON, SW3:3 OFF |
| | Transmitter 2 |   SW3:1 ON, SW3:3 OFF | |

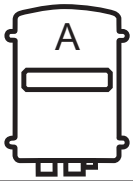
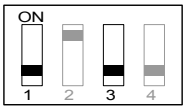
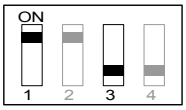
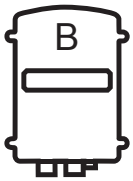
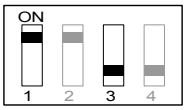
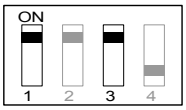
## 7.5.2 Tandem operation

### 1 transmitter and 2 receivers

In order to run tandem operation the receivers must be paired with the same ID.

1. Pair the transmitter to receiver 1 (A). Disconnect the power source to the receiver, set the SW3 in "during operation" and reconnect the power source to the receiver.
2. Pair the transmitter to receiver 2 (B). Disconnect the power source to the receiver, set the SW3 in "during operation" and reconnect the power source to the receiver.




| | | During pairing | During operation |
|---|---|---|---|
| Receiver A   | Transmitter 1 |   SW3:1 OFF, SW3:3 OFF |   SW3:1 ON, SW3:3 OFF |
| Receiver B   | Transmitter 1 |   SW3:1 ON, SW3:3 OFF |   SW3:1 ON, SW3:3 ON |

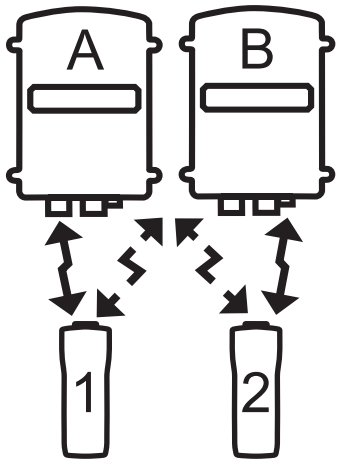
## 7.5.3 Tandem operator operation & Multi-operator operation

### 2 transmitters and 2 receivers

In order to run tandem/multi-operator operation the receivers must be paired with two ID's.

1. Pair transmitter 1 to receiver 1 (A). Disconnect and reconnect the power source to the receiver.
2. Pair transmitter 2 to receiver 1 (A). Disconnect the power source to the receiver, set the SW3 in "during operation" and reconnect the power source to the receiver.
3. Pair transmitter 2 to receiver 2 (B). Disconnect and reconnect the power source to the receiver.
4. Pair transmitter 1 to receiver 2 (B). Disconnect the power source to the receiver, set the SW3 in "during operation" and reconnect the power source to the receiver.

Transmitter 1 primary transmitter for receiver 1 (A). Transmitter 2 primary transmitter for receiver 2 (B).




| | | During pairing | During operation |
|---|---|---|---|
| Receiver A | Transmitter 1 | SW3:1 OFF, SW3:3 OFF | SW3:1 ON, SW3:3 OFF |
| | Transmitter 2 | SW3:1 ON, SW3:3 OFF | |
| Receiver B | Transmitter 2 | SW3:1 OFF, SW3:3 OFF | SW3:1 ON, SW3:3 ON |
| | Transmitter 1 | SW3:1 ON, SW3:3 OFF | |

## 7.5.4 Tandem operator operation & Multi-operator operation (Primary/Secondary)

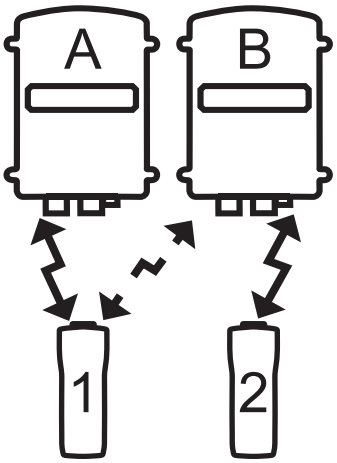
**2 transmitters and 2 receivers (one of the transmitters can only operate one crane)**

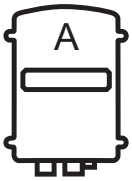
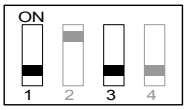
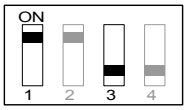
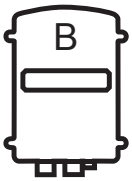
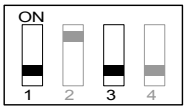
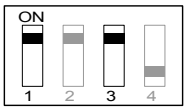
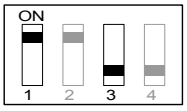
In order to run tandem/multi-operator operation the receivers must be paired with two ID's.

1. Pair transmitter 1 to receiver 1 (A). Disconnect the power source to the receiver, set the SW3 in "during operation" and reconnect the power source to the receiver.
2. Pair transmitter 2 to receiver 2 (B). Disconnect and reconnect the power source to the receiver.
3. Pair transmitter 1 to receiver 2 (B). Disconnect the power source to the receiver, set the SW3 in "during operation" and reconnect the power source to the receiver.

**Transmitter 1**, can operate both cranes, primary transmitter for receiver 1 (A) and secondary for receiver 2 (B).

**Transmitter 2**, can operate one crane, primary transmitter for receiver 2 (B).




| | | During pairing | During operation |
|---|---|---|---|
| Receiver A   | Transmitter 1 |   SW3:1 OFF, SW3:3 OFF |   SW3:1 ON, SW3:3 OFF |
| Receiver B   | Transmitter 2 |   SW3:1 OFF, SW3:3 OFF |   SW3:1 ON, SW3:3 ON |
| | Transmitter 1 |   SW3:1 ON, SW3:3 OFF | |

### 7.6 *CIM Card*

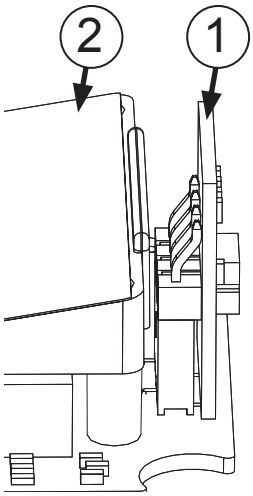
The CIM card is used for storing configuration information. You can take out the CIM-module from one system and place it in a spare transmitter with the same system program and it will work exactly* the same.

This exchange has to be done in a clean, dry and ESD safe environment.

**! To avoid personal and/or damages on property; exchange CIM card ONLY when the transmitter battery has been removed.**

**! *Note that some settings do not follow with the CIM card and need to be set in the "spare" transmitter. These settings are; Radio comm power, FX sequence 0-119 and Remote type.**

#### 7.6.1 Removing/Mounting CIM Card




1. To disassemble the transmitter, remove the battery, unscrew the six screws* holding the back cover of the transmitter, pull up the back of the transmitter carefully and pull out the connector for the battery and remove the back enclosure entirely.
   *Note that the screw below the battery is underneath the type label. Make a little cut on the type label around the screw; so not the entire type label is damage when removing the screw.
2. The CIM card ① is located at the top of the transmitter above the display board ②. Gently remove the CIM card straight up.
3. Install the CIM card primarily in the original transmitter, alternative spare transmitter. Be sure to insert the CIM card properly in its connector.
4. Reinstall the enclosure. The screws should be tightened with 0.35Nm±0.05.
5. Insert battery. Now, the transmitter is ready for operation.

## 8 Function tests

Before the following test is performed, make sure to prevent unintended movements of the controlled object from becoming a safety hazard.

Check that the transmitter can control the receiver by testing all functions and note if the output relays and the corresponding inputs on the controlled object are activated.

Follow the local safety regulations for the equipment and start the equipment as described in the Operator Manual.

Check the following:

- Are all movements correct?
- Do the other functions operate correctly?
- Does the stop function on the transmitter work properly?
- Also test the stop function by removing the battery in the transmitter.
- Is it possible to control the equipment from the normal controllers? If it is possible to operate the equipment from more than one controller at a time the system is incorrectly installed.
- There should be a changeover switch between radio/pendant controls to prevent control from two places at the same time.
- Test that all the safety and stop limits switches work.

This list of test is for reference only and can be extended by the system integrator in the specific installations and the corresponding risk analysis.

# 9 Indications

## 9.1 Receiver indications

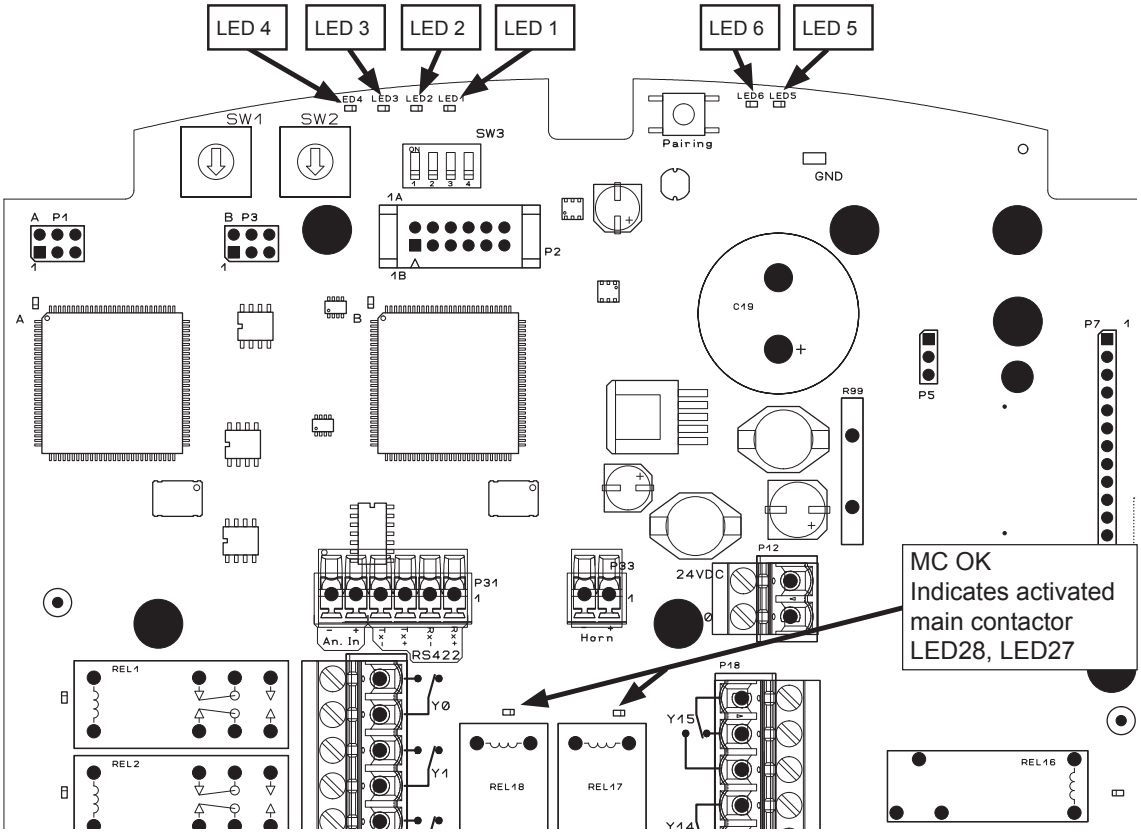



*Figure 13. Indications on the MAIN board*

| Mode | Event | Indication on RX | Flash rate |
|---|---|---|---|
| **LED 1-4** | | | |
| **TX command change** | Changes in the transmitter switches or joysticks | LED 1 flashes | |
| **Digital input data change** | | LED 2 flashes | |
| **Message received** | | LED 3 | |
| **Squelch** | Signal strength > -90 dBm | LED 4 | |
| **LED 5-6** | | | ON/OFF |
| **System OK** | Not connected | LED 5 fast | 50/50 ms |
| | Connected, MC=OFF | LED 5 slow | 50/250 ms |
| | Connected, MC=ON | LED 5 extra slow | 30/970 ms |
| | 50% time out | LED 5 and LED 6 steady | |
| **ERROR** | Receiver internal error | LED 6 steady | |
| | Transmitter internal error | LED 6 fast | 50/50 ms |
| **Pairing** | In pairing mode | LED 5 steady<br>LED 6 fast | 50/50 ms |
| | Paired | LED 5 steady | |
| **LED 27-28** | | | |
| **MC activated** | | LED 27 & 28 steady | |

*Table 6. Mode, event and indications on the MAIN board*

## 9.2 *Transmitter indications*

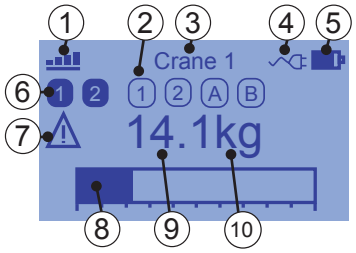
### 9.2.1 Status indicator

If the transmitter under start up (if not PIN locked) or operation detects a fault in any of the transmitters self-tests, the status indicator (see section 12) will indicate a continuous red light, after which the transmitter is shut down.

| INDICATIONS | EXPLANATIONS |
|---|---|
| Green flashing | OK, normal operation |
| Yellow quick flashing | Battery voltage low <3.5 V |
| Yellow continuous, during operating | Battery empty. Transmitter will shut-off within 10s |
| Yellow continuous, at start-up | Configuration mode |
| Red continuous, at start-up | PIN locked |
| Red continuous, during operation | Hardware fault |
| Blue continuous, other indications may occur simultaneously | High power |

### 9.2.2 Display indications

These default symbols can appear on the display depending on the configuration. For configuration see RX160 configuration tool manual.




1. Radio signal / MC
2. SHIFT-selection (Era 8B 9/10 Buttons)
3. Text field (crane id etc.)
4. External power supply
5. Battery level
6. Dig. In 1 & 2 (shows if active)
7. Overload warning
8. Weight load graph (full-scale=max load)
9. Weight, up to 5 digits
10. Weight unit (kg,t or lb)

#### 9.2.2.1 Radio signal quality

| No radio link established | Weak signal | Good signal | Strong signal | Very strong signal |
|---|---|---|---|---|
| ✕ | ▪ | ▪▪ | ▪▪▪ | ▪▪▪▪ |

MC on is indicated by a line beneath the radio signal symbol, example ▪▪▪▪.

#### 9.2.2.2 Text field (crane id etc.) (option)

This text is configured in the receiver (8 characters) using the RX160 configuration tool.

#### 9.2.2.3 Battery level

| Battery empty | 25% | 50% | 75% | 100% (fully charged) |
|---|---|---|---|---|
| ▭ | ▮ | ▮ | ▮ | ▮ |

#### 9.2.2.4 Weight / Graph / Overload (option)

The weight is shown with the unit symbol kg, t or lb. depending on the receiver configuration.
The bar graph displays the weight load. Full scale= maximum load. The graph is only shown if a maximum weight limit is configured in the receiver.

This ⚠ symbol appears if the load on the crane reaches the weight limit (overload).
Refer to the RX160 configuration tool.

#### 9.2.2.5 SHIFT-selection (only Era 8B 9/10 BUTTONS)

Shows which selections that currently are active.

# 10 Trouble shooting

## 10.1 First check

**On push button transmitter:**

Ensure that a charged battery is inserted in the transmitter.

The status indicator indicates following:

- Slow green flashing means that the transmitter is fully operational
- Fast yellow flashing means that the battery needs charging
- Steady yellow light means that the transmitter is in configuration mode
- Steady red light at start up means that the transmitter is PIN locked
- Steady red light during operating means that an error in the transmitter has been discovered and it will shut itself down

**In receiver:**

- Check the indications of mode “Error”, “MC activated” and “System OK”, see Table 6 on page 29.

## 10.2 It is impossible to activate the main contactor

The transmitter has not been paired with the receiver. For LED position see Figure 13.

Indication Squelch (LED 4) is flashing or lit but the transmitter is off.

- This means that some or all frequencies are used. Try an alternative frequency setting.

Indication Message received (LED 3) does not flash and the transmitter is on.

- Check the antenna on the receiver.
- All the settings are correct on both the transmitter and the receiver; the system must be checked by authorised personnel.

Indication Message received (LED 3) lit and indication LED 5 lit but the main contactor remains deactivated.

- Check the instructions in the operator’s manual dealing with activation of the main contactor. Normally the horn/siren push button must be pressed to activate the main contactor. At start up the push buttons or joystick must be in not activated position.
- A fault in the receiver prevents the main contactor to be activated.

### 10.3 Some output functions do not work

If the LEDs indicate the output function the fault is likely to be found in the relay itself or in the cables/ contacts or in the controlled units' electronics.

If no LEDs are indicate the output function the fault is likely to be found in the transmitter.

Note LED1 is flashing if a command is changed from the transmitter.

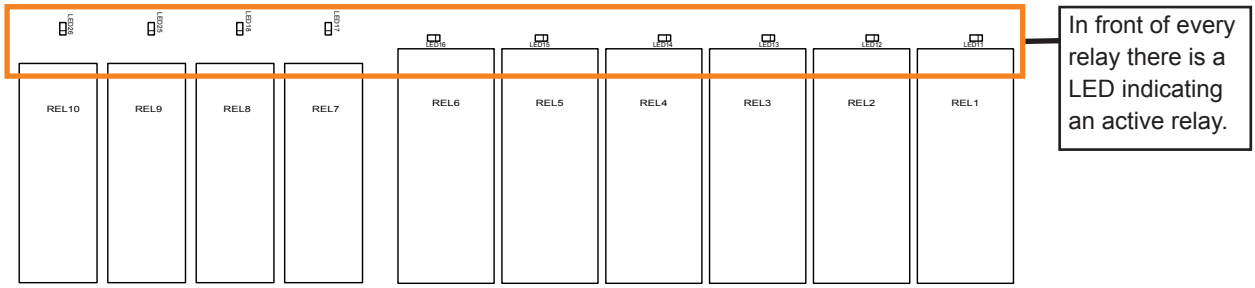
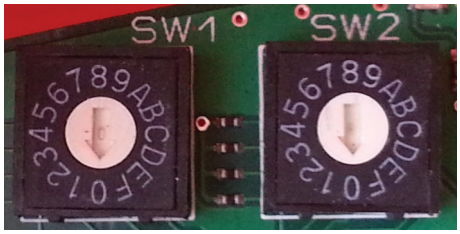



*Figure 14. LED indicators indicating active outputs*

## 11 Program Selection

There are two rotary switches for program selection in the receiver, see section 11.1, rotary switch SW1 and SW2. For position on the main board see Figure 3 on page 10.




Note! The switches must be set to the same position.

### 11.1 Program Selection list

If nothing but the movement itself is described in the function column it means step 1+2 on the button transmitter. Low speed step 1 and high speed step 2. SHIFT=B8 step 2 for Era 8B 9/10 Buttons.

For symbols on the transmitter see chapter "12 Layout transmitters" on page 41.
For relay see "Figure 5. Relay symbol explanation" on page 12.

Every program option is for 3 movements and 2 steps.

Safety relays (Y0-Y5) for movements is indicated by **bold text** in the function column**.**

| | |
|---|---|
| ! **For Australia it is a 5 second delay for the "lamp"** | |
| ! **For Australia: Program option D = 1 but with the difference that output Y11 is activated by Up/Down/North/South/East/West-" movement activated"** | |
| ! **Difference in program selection at Tandem/Multi-operator operation:** | |
| **Program option 0:** | ! Not available for tandem/multi-operator operation. |
| **Program option 1-D:** | Y14 indication driver A and Y15 indication driver B |
| **Program option 1,2,4,6,A,B,D:** | Y13 interconnection crane A & B |
| **Program option 3,5,7,8,9,C:** | Y9 interconnection crane A & B |

| Program Option 0 - 8pcs Single functions for JUPITER Era 4/6/8B | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | | |
| | | | **8B** | **6B** | **4B** |
| P21 | Y4 | | **B1** | **B1** | **B1** |
| | Y5 | | **B2** | **B2** | **B2** |
| | Y6 | | B3 | B3 | - |
| | Y7 | | B4 | B4 | - |
| P27 | Y8 | | B5 | - | - |
| | Y9 | | B6 | - | - |
| P20 | Y10 | | - | - | - |
| | Y11 | | - | - | - |
| | Y12 | | B7 | B7 | B7 |
| | Y13 | | B8 | B8 | B8 |
| P18 | Y14 | | - | - | - |
| | Y15 | | - | - | - |

| Program Option 1 - 3 outputs per movement | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward** | **B5** | **B6** |
| | Y1 | | **Bridge backward** | **B6** | **B5** |
| | Y2 | | **Trolley left** | **B3** | **B3** |
| | Y3 | | **Trolley right** | **B4** | **B4** |
| P21 | Y4 | | **Hoist down** | **B2** | **B1** |
| | Y5 | | **Hoist up** | **B1** | **B2** |
| | Y6 | | Bridge high speed | 2nd B5/B6 | 2nd B6/B5 |
| | Y7 | | Trolley high speed | 2nd B3/B4 | 2nd B3/B4 |
| P27 | Y8 | | Trolley 1/Selection 1 | B5 + SHIFT | B5 + SHIFT |
| | Y9 | | Trolley 2/Selection 2 | B6 + SHIFT | B6 + SHIFT |
| P20 | Y10 | | Hoist high speed | 2nd B2/B1 | 2nd B1/B2 |
| | Y11 | | X | 2nd B7 | 2nd B7 |
| | Y12 | | Y | 2nd B8 | 2nd B8 |
| | Y13 | | A | SHIFT + B3 | SHIFT + B3 |
| P18 | Y14 | | B | SHIFT + B4 | SHIFT + B4 |
| | Y15 | | Horn (Signal) | 1st B7 | 1st B7 |

| Program Option 2 - Different outputs for high speed up and down | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward** | **B5** | **B6** |
| | Y1 | | **Bridge backward** | **B6** | **B5** |
| | Y2 | | **Trolley left** | **B3** | **B3** |
| | Y3 | | **Trolley right** | **B4** | **B4** |
| P21 | Y4 | | **Hoist down** | **B2** | **B1** |
| | Y5 | | **Hoist up** | **B1** | **B2** |
| | Y6 | | Bridge high speed | 2nd B5/B6 | 2nd B6/B5 |
| | Y7 | | Trolley high speed | 2nd B3/B4 | 2nd B3/B4 |
| P27 | Y8 | | Trolley 1/Selection 1 | SHIFT + B5 | SHIFT + B5 |
| | Y9 | | Trolley 2/Selection 2 | SHIFT + B6 | SHIFT + B6 |
| P20 | Y10 | | Hoist down high speed | 2nd B2 | 2nd B1 |
| | Y11 | | Hoist up high speed | 2nd B1 | 2nd B2 |
| | Y12 | | X | 2nd B7 | 2nd B7 |
| | Y13 | | Y | 2nd B8 | 2nd B8 |
| P18 | Y14 | | A | SHIFT +B3 | SHIFT + B3 |
| | Y15 | | B / (Horn button 8B/10B) | SHIFT + B4 / 1st B7 | SHIFT + B4 / 1st B7 |

| Program Option 3 - All high speed outputs are separately (X/Y function) | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward** | **B5** | **B6** |
| | Y1 | | **Bridge backward** | **B6** | **B5** |
| | Y2 | | **Trolley left** | **B3** | **B3** |
| | Y3 | | **Trolley right** | **B4** | **B4** |
| P21 | Y4 | | **Hoist down** | **B2** | **B1** |
| | Y5 | | **Hoist up** | **B1** | **B2** |
| | Y6 | | Bridge forward high speed | 2nd B5 | 2nd B6 |
| | Y7 | | Bridge backward high speed | 2nd B6 | 2nd B5 |
| P27 | Y8 | | Trolley 1/Selection 1 | SHIFT + B5 | SHIFT + B5 |
| | Y9 | | Trolley 2/Selection 2 | SHIFT + B6 | SHIFT + B6 |
| P20 | Y10 | | Trolley left high speed | 2nd B3 | 2nd B3 |
| | Y11 | | Trolley right high speed | 2nd B4 | 2nd B4 |
| | Y12 | | Hoist down high speed | 2nd B2 | 2nd B1 |
| | Y13 | | Hoist up high speed | 2nd B1 | 2nd B2 |
| P18 | Y14 | | X | 2nd B7 | 2nd B7 |
| | Y15 | | Y | 2nd B8 | 2nd B8 |

| Program Option 4 - 3 outputs per movement + MC-ON function. (KONECRANES) | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward** | **B5** | **B6** |
| | Y1 | | **Bridge backward** | **B6** | **B5** |
| | Y2 | | **Trolley left** | **B3** | **B3** |
| | Y3 | | **Trolley right** | **B4** | **B4** |
| P21 | Y4 | | **Hoist down** | **B2** | **B1** |
| | Y5 | | **Hoist up** | **B1** | **B2** |
| | Y6 | | Bridge high speed | 2nd B5/B6 | 2nd B6/B5 |
| | Y7 | | Trolley high speed | 2nd B3/B4 | 2nd B3/B4 |
| P27 | Y8 | | Trolley 1/Selection 1 | SHIFT + B5 | SHIFT + B5 |
| | Y9 | | Trolley 2/Selection 2 | SHIFT + B6 | SHIFT + B6 |
| P20 | Y10 | | Hoist high speed | 2nd B2/B1 | 2nd B1/B2 |
| | Y11 | | MC ON | 1st B7 | 1st B7 |
| | Y12 | | X | 2nd B7 | 2nd B7 |
| | Y13 | | Y | 2nd B8 | 2nd B8 |
| P18 | Y14 | | A | SHIFT + B3 | SHIFT + B3 |
| | Y15 | | B / (Horn button 8B/10B) | SHIFT + B4 / 1st B7 | SHIFT + B4 / 1st B7 |

| Program Option 5 - Outputs for low speed and high speed for each movement (X/Y function) | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward** | **B5** | **B6** |
| | Y1 | | **Bridge backward** | **B6** | **B5** |
| | Y2 | | **Trolley left** | **B3** | **B3** |
| | Y3 | | **Trolley right** | **B4** | **B4** |
| P21 | Y4 | | **Hoist down** | **B2** | **B1** |
| | Y5 | | **Hoist up** | **B1** | **B2** |
| | Y6 | | Bridge low speed | 1st B5/B6 | 1st B6/B5 |
| | Y7 | | Bridge high speed | 2nd B5/B6 | 2nd B6/B5 |
| P27 | Y8 | | Trolley 1/Selection 1 | SHIFT + B5 | SHIFT + B5 |
| | Y9 | | Trolley 2/Selection 2 | SHIFT + B6 | SHIFT + B6 |
| P20 | Y10 | | Trolley low speed | 1st B3/B4 | 1st B3/B4 |
| | Y11 | | Trolley high speed | 2nd B3/B4 | 2nd B3/B4 |
| | Y12 | | Hoist low speed | 1st B2/B1 | 1st B1/B2 |
| | Y13 | | Hoist high speed | 2nd B2/B1 | 2nd B1/B2 |
| P18 | Y14 | | X | 2nd B7 | 2nd B7 |
| | Y15 | | Y | 2nd B8 | 2nd B8 |

| Program Option 6 - Different outputs for high speed up and down + MC ON function | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward** | **B5** | **B6** |
| | Y1 | | **Bridge backward** | **B6** | **B5** |
| | Y2 | | **Trolley left** | **B3** | **B3** |
| | Y3 | | **Trolley right** | **B4** | **B4** |
| P21 | Y4 | | **Hoist down** | **B2** | **B1** |
| | Y5 | | **Hoist up** | **B1** | **B2** |
| | Y6 | | Bridge high speed | 2nd B5/B6 | 2nd B6/B5 |
| | Y7 | | Trolley high speed | 2nd B3/B4 | 2nd B3/B4 |
| P27 | Y8 | | Trolley 1/Selection 1 | SHIFT + B5 | SHIFT + B5 |
| | Y9 | | Trolley 2/Selection 2 | SHIFT + B6 | SHIFT + B6 |
| P20 | Y10 | | Hoist down high speed | 2nd B2 | 2nd B1 |
| | Y11 | | MC ON | 1st B7 | 1st B7 |
| | Y12 | | Hoist up high speed | 2nd B1 | 2nd B2 |
| | Y13 | | A | SHIFT + B3 | SHIFT + B3 |
| P18 | Y14 | | B / (Horn button 8B/10B) | SHIFT + B4 / 1st B7 | SHIFT + B4 / 1st B7 |
| | Y15 | | X | 2nd B7 | 2nd B7 |

| Program Option 7 - All high speed outputs are separately (A/B function) | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward** | **B5** | **B6** |
| | Y1 | | **Bridge backward** | **B6** | **B5** |
| | Y2 | | **Trolley left** | **B3** | **B3** |
| | Y3 | | **Trolley right** | **B4** | **B4** |
| P21 | Y4 | | **Hoist down** | **B2** | **B1** |
| | Y5 | | **Hoist up** | **B1** | **B2** |
| | Y6 | | Bridge forward high speed | 2nd B5 | 2nd B6 |
| | Y7 | | Bridge backward high speed | 2nd B6 | 2nd B5 |
| P27 | Y8 | | Trolley 1/Selection 1 | SHIFT + B5 | SHIFT + B5 |
| | Y9 | | Trolley 2/Selection 2 | SHIFT + B6 | SHIFT + B6 |
| P20 | Y10 | | Trolley left high speed | 2nd B3 | 2nd B3 |
| | Y11 | | Trolley right high speed | 2nd B4 | 2nd B4 |
| | Y12 | | Hoist down high speed | 2nd B2 | 2nd B1 |
| | Y13 | | Hoist up high speed | 2nd B1 | 2nd B2 |
| P18 | Y14 | | A | SHIFT + B3 | SHIFT + B3 |
| | Y15 | | B / (Horn button 8B/10B) | SHIFT + B4 / 1st B7 | SHIFT + B4 / 1st B7 |

| Program Option 8 - Outputs for low speed and high speed for each movement (A/B function) | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward** | **B5** | **B6** |
| | Y1 | | **Bridge backward** | **B6** | **B5** |
| | Y2 | | **Trolley left** | **B3** | **B3** |
| | Y3 | | **Trolley right** | **B4** | **B4** |
| P21 | Y4 | | **Hoist down** | **B2** | **B1** |
| | Y5 | | **Hoist up** | **B1** | **B2** |
| | Y6 | | Bridge low speed | 1st B5/B6 | 1st B6/B5 |
| | Y7 | | Bridge high speed | 2nd B5/B6 | 2nd B6/B5 |
| P27 | Y8 | | Trolley 1/Selection 1 | SHIFT + B5 | SHIFT + B5 |
| | Y9 | | Trolley 2/Selection 2 | SHIFT + B6 | SHIFT + B6 |
| P20 | Y10 | | Trolley low speed | 1st B3/B4 | 1st B3/B4 |
| | Y11 | | Trolley high speed | 2nd B3/B4 | 2nd B3/B4 |
| | Y12 | | Hoist low speed | 1st B2/B1 | 1st B1/B2 |
| | Y13 | | Hoist high speed | 2nd B2/B1 | 2nd B1/B2 |
| P18 | Y14 | | A | SHIFT + B3 | SHIFT + B3 |
| | Y15 | | B / (Horn button 8B/10B) | SHIFT + B4 / 1st B7 | SHIFT + B4 / 1st B7 |

| Program Option 9 - Low speed in first step disappears in the second step (X/Y function) | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward low speed** | **1st B5** | **1st B6** |
| | Y1 | | **Bridge backward low speed** | **1st B6** | **1st B5** |
| | Y2 | | **Trolley left low speed** | **1st B3** | **1st B3** |
| | Y3 | | **Trolley right low speed** | **1st B4** | **1st B4** |
| P21 | Y4 | | **Hoist down low speed** | **1st B2** | **1st B1** |
| | Y5 | | **Hoist up low speed** | **1st B1** | **1st B2** |
| | Y6 | | Bridge forward high speed | 2nd B5 | 2nd B6 |
| | Y7 | | Bridge backward high speed | 2nd B6 | 2nd B5 |
| P27 | Y8 | | Trolley 1/Selection 1 | SHIFT + B5 | SHIFT + B5 |
| | Y9 | | Trolley 2/Selection 2 | SHIFT + B6 | SHIFT + B6 |
| P20 | Y10 | | Trolley left high speed | 2nd B3 | 2nd B3 |
| | Y11 | | Trolley right high speed | 2nd B4 | 2nd B4 |
| | Y12 | | Hoist down high speed | 2nd B2 | 2nd B1 |
| | Y13 | | Hoist up high speed | 2nd B1 | 2nd B2 |
| P18 | Y14 | | X | 2nd B7 | 2nd B7 |
| | Y15 | | Y | 2nd B8 | 2nd B8 |

| Program Option A - Different outputs for high speed up and down. Transition from high speed to low speed – delayed 1s. (DEMAG, Dematek) | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward** | **B5** | **B6** |
| | Y1 | | **Bridge backward** | **B6** | **B5** |
| | Y2 | | **Trolley left** | **B3** | **B3** |
| | Y3 | | **Trolley right** | **B4** | **B4** |
| P21 | Y4 | | **Hoist down** | **B2** | **B1** |
| | Y5 | | **Hoist up** | **B1** | **B2** |
| | Y6 | | Bridge high speed | 2nd B5/B6 | 2nd B6/B5 |
| | Y7 | | Trolley high speed | 2nd B3/B4 | 2nd B3/B4 |
| P27 | Y8 | | Trolley 1/Selection 1 | B5 + SHIFT | B5 + SHIFT |
| | Y9 | | Trolley 2/Selection 2 | B6 + SHIFT | B6 + SHIFT |
| P20 | Y10 | | Hoist down high speed | 2nd B2 | 2nd B1 |
| | Y11 | | Hoist up high speed | 2nd B1 | 2nd B2 |
| | Y12 | | X | 2nd B7 | 2nd B7 |
| | Y13 | | Y | 2nd B8 | 2nd B8 |
| P18 | Y14 | | A | SHIFT + B3 | SHIFT + B3 |
| | Y15 | | B / (Horn button 8B/10B) | SHIFT + B4 / 1st B7 | SHIFT + B4 / 1st B7 |

| Program Option B - 3 outputs per movement. Blocked 1s with zero position transition. (ABUS) | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward** | **B5** | **B6** |
| | Y1 | | **Bridge backward** | **B6** | **B5** |
| | Y2 | | **Trolley left** | **B3** | **B3** |
| | Y3 | | **Trolley right** | **B4** | **B4** |
| P21 | Y4 | | **Hoist down** | **B2** | **B1** |
| | Y5 | | **Hoist up** | **B1** | **B2** |
| | Y6 | | Bridge high speed | 2nd B5/B6 | 2nd B6/B5 |
| | Y7 | | Trolley high speed | 2nd B3/B4 | 2nd B3/B4 |
| P27 | Y8 | | Trolley 1/Selection 1 | B5 + SHIFT | B5 + SHIFT |
| | Y9 | | Trolley 2/Selection 2 | B6 + SHIFT | B6 + SHIFT |
| P20 | Y10 | | Hoist high speed | 2nd B2/B1 | 2nd B1/B2 |
| | Y11 | | X | 2nd B7 | 2nd B7 |
| | Y12 | | Y | 2nd B8 | 2nd B8 |
| | Y13 | | (A) | (SHIFT + B3) | (SHIFT + B3) |
| P18 | Y14 | | (B) | (SHIFT + B4) | (SHIFT + B4) |
| | Y15 | | Horn | 1st B7 | 1st B7 |

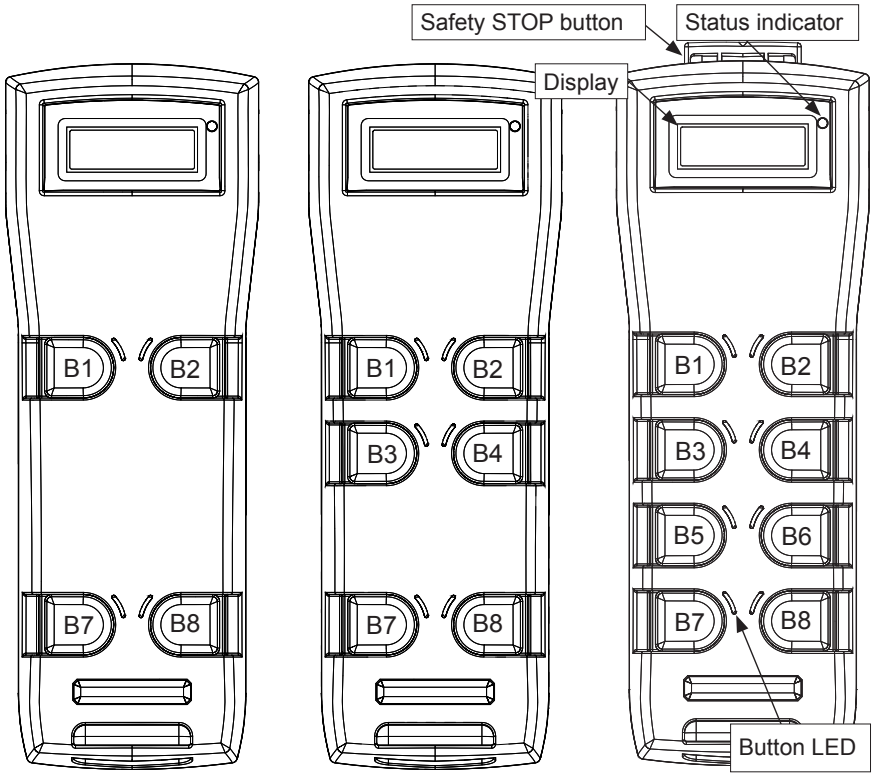
| Program Option C - Low speed in first step disappears in the second step (A/B function) | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward low speed** | **1st B5** | **1st B6** |
| | Y1 | | **Bridge backward low speed** | **1st B6** | **1st B5** |
| | Y2 | | **Trolley left low speed** | **1st B3** | **1st B3** |
| | Y3 | | **Trolley right low speed** | **1st B4** | **1st B4** |
| P21 | Y4 | | **Hoist down low speed** | **1st B2** | **1st B1** |
| | Y5 | | **Hoist up low speed** | **1st B1** | **1st B2** |
| | Y6 | | Bridge forward high speed | 2nd B5 | 2nd B6 |
| | Y7 | | Bridge backward high speed | 2nd B6 | 2nd B5 |
| P27 | Y8 | | Trolley 1/Selection 1 | SHIFT + B5 | SHIFT + B5 |
| | Y9 | | Trolley 2/Selection 2 | SHIFT + B6 | SHIFT + B6 |
| P20 | Y10 | | Trolley left high speed | 2nd B3 | 2nd B3 |
| | Y11 | | Trolley right high speed | 2nd B4 | 2nd B4 |
| | Y12 | | Hoist down high speed | 2nd B2 | 2nd B1 |
| | Y13 | | Hoist up high speed | 2nd B1 | 2nd B2 |
| P18 | Y14 | | A | SHIFT + B3 | SHIFT + B3 |
| | Y15 | | B / (Horn button 8B/10B) | SHIFT + B4 / 1st B7 | SHIFT + B4 / 1st B7 |

| Program Option D - Hoist low speed | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward** | **B5** | **B6** |
| | Y1 | | **Bridge backward** | **B6** | **B5** |
| | Y2 | | **Trolley left** | **B3** | **B3** |
| | Y3 | | **Trolley right** | **B4** | **B4** |
| P21 | Y4 | | **Hoist down low speed** | **1st B2** | **1st B1** |
| | Y5 | | **Hoist up low speed** | **1st B1** | **1st B2** |
| | Y6 | | Bridge high speed | 2nd B5/B6 | 2nd B6/B5 |
| | Y7 | | Trolley high speed | 2nd B3/B4 | 2nd B3/B4 |
| P27 | Y8 | | Trolley 1/Selection 1 | SHIFT + B5 | SHIFT + B5 |
| | Y9 | | Trolley 2/Selection 2 | SHIFT + B6 | SHIFT + B6 |
| P20 | Y10 | | Hoist down high speed | 2nd B2 | 2nd B1 |
| | Y11 | | Hoist up high speed | 2nd B1 | 2nd B2 |
| | Y12 | | X | 2nd B7 | 2nd B7 |
| | Y13 | | Y | 2nd B8 | 2nd B8 |
| P18 | Y14 | | A | SHIFT + B3 | SHIFT + B3 |
| | Y15 | | B / (Horn button 8B/10B) | SHIFT + B4 / 1st B7 | SHIFT + B4 / 1st B7 |

| Program Option E - 3 outputs per movement with common movement indication output on Y12 | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward** | **B5** | **B6** |
| | Y1 | | **Bridge backward** | **B6** | **B5** |
| | Y2 | | **Trolley left** | **B3** | **B3** |
| | Y3 | | **Trolley right** | **B4** | **B4** |
| P21 | Y4 | | **Hoist down** | **B2** | **B1** |
| | Y5 | | **Hoist up** | **B1** | **B2** |
| | Y6 | | Bridge high speed | 2nd B5/B6 | 2nd B6/B5 |
| | Y7 | | Trolley high speed | 2nd B3/B4 | 2nd B3/B4 |
| P27 | Y8 | | Trolley 1/Selection 1 | B5 + SHIFT | B5 + SHIFT |
| | Y9 | | Trolley 2/Selection 2 | B6 + SHIFT | B6 + SHIFT |
| P20 | Y10 | | Hoist high speed | 2nd B2/B1 | 2nd B1/B2 |
| | Y11 | | X | 2nd B7 | 2nd B7 |
| | Y12 | | Common movement indication | B1-B4 | B1-B4 |
| | Y13 | | A | SHIFT + B3 | SHIFT + B3 |
| P18 | Y14 | | B | SHIFT + B4 | SHIFT + B4 |
| | Y15 | | Horn (Signal) | 1st B7 | 1st B7 |

| Program Option F - 3 outputs per movement + MC-ON function. With common movement indication output on Y12 | | | | | |
|---|---|---|---|---|---|
| Terminal | Connector | Cable part | Function | Button no. | Button no. DIN |
| P15 | Y0 | | **Bridge forward** | **B5** | **B6** |
| | Y1 | | **Bridge backward** | **B6** | **B5** |
| | Y2 | | **Trolley left** | **B3** | **B3** |
| | Y3 | | **Trolley right** | **B4** | **B4** |
| P21 | Y4 | | **Hoist down** | **B2** | **B1** |
| | Y5 | | **Hoist up** | **B1** | **B2** |
| | Y6 | | Bridge high speed | 2nd B5/B6 | 2nd B6/B5 |
| | Y7 | | Trolley high speed | 2nd B3/B4 | 2nd B3/B4 |
| P27 | Y8 | | Trolley 1/Selection 1 | SHIFT + B5 | SHIFT + B5 |
| | Y9 | | Trolley 2/Selection 2 | SHIFT + B6 | SHIFT + B6 |
| P20 | Y10 | | Hoist high speed | 2nd B2/B1 | 2nd B1/B2 |
| | Y11 | | MC ON | 1st B7 | 1st B7 |
| | Y12 | | Common movement indication | B1-B4 | B1-B4 |
| | Y13 | | Y | 2nd B8 | 2nd B8 |
| P18 | Y14 | | A | SHIFT + B3 | SHIFT + B3 |
| | Y15 | | B / (Horn button 8B/10B) | SHIFT + B4 / 1st B7 | SHIFT + B4 / 1st B7 |

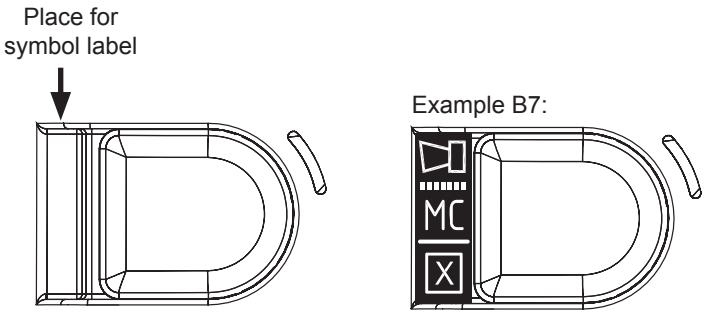
# 12 Layout transmitters




## 12.1 Place symbol label

Alongside the buttons there is room for a symbol label. A sheet of symbol labels are included with the delivery.

1. Before placing the label, clean the surface with alcohol (do not use isopropyl alcohol).
2. Place the label; make sure that the symbol label is placed at the right button! See Table 7 and Table 8 on page 42.



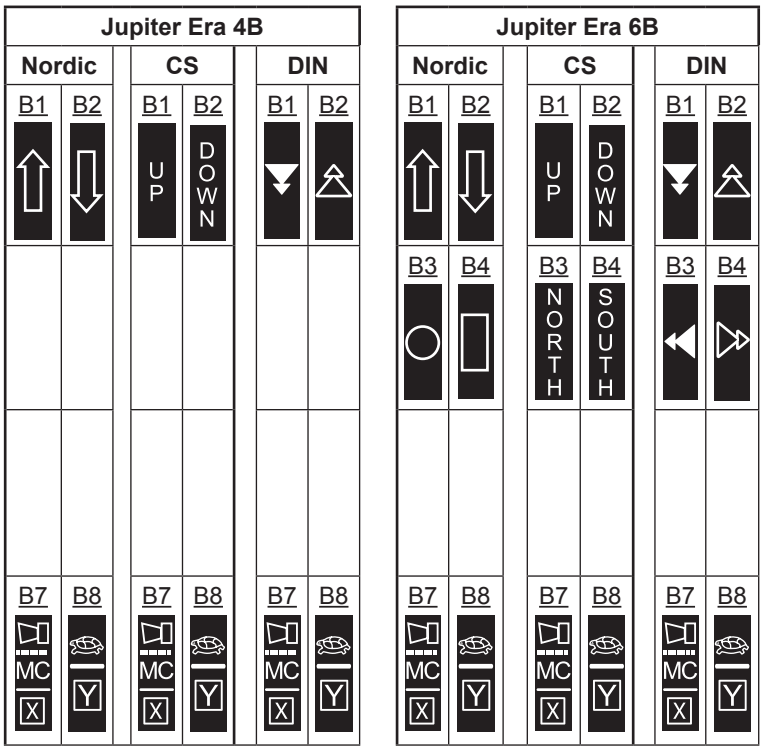



*Table 7. Symbol placement for Era 4B and 6B*

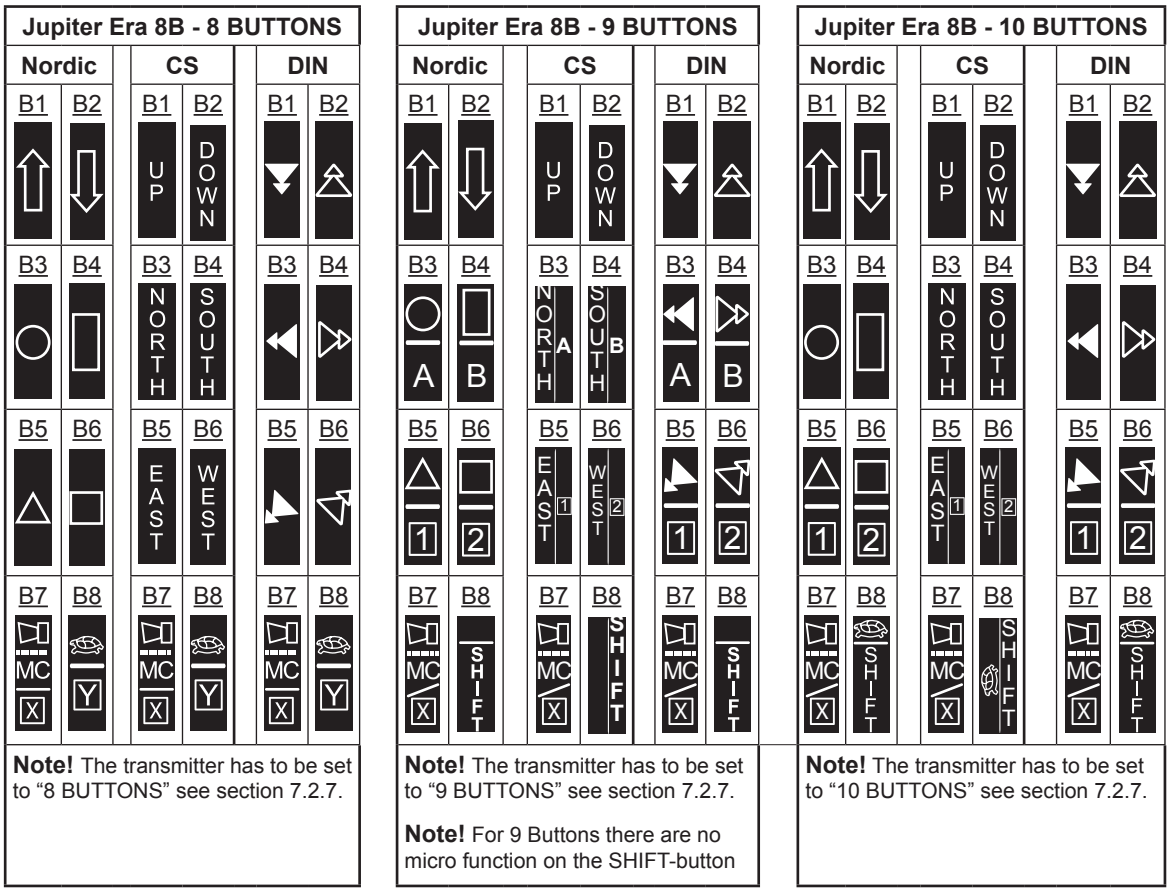



*Table 8. Symbol placement for the different types of Era 8B*

## 12.2 *Symbol explanation*

| | | |
|---|---|---|
| **Siren (B7 1st step)** | | |
| **MC (B7 1st step)** | Activation of Main Contactor in the receiver | MC |
| **Extra (B7 2nd step)** | Optional feature | X |
| **Micro (B8 1st step)** | Slow speed operation | |
| **Extra (B8 2nd step)** | Optional feature | Y |
| **SHIFT** | B8 step 2 on Era 8B 9/10 buttons | |
| **Selection 1** | (B5 + B8-SHIFT, Era 8B 9/10 buttons) (Trolley 1) | 1 |
| **Selection 2** | (B6 + B8-SHIFT, Era 8B 9/10 buttons) (Trolley 2) | 2 |
| **Selection A** | (B3 + B8-SHIFT, Era 8B 9 buttons) (Crane A) | A |
| **Selection B** | (B4 + B8-SHIFT, Era 8B 9 buttons) (Crane B) | B |

**NORDIC SYMBOLS:**

| | | | | |
|---|---|---|---|---|
| **Hoist** | Up | (B1) | Down | (B2) |
| **Trolley** | Left | (B3) | Right | (B4) |
| **Bridge** | Forward | (B5) | Reverse | (B6) |

**DIN SYMBOLS:**

| | | | | |
|---|---|---|---|---|
| **Hoist** | Down | (B1) | Up | (B2) |
| **Trolley** | Left | (B3) | Right | (B4) |
| **Bridge** | Reverse |  (B5) | Forward |  (B6) |

**CS SYMBOLS:**

| | | | | |
|---|---|---|---|---|
| **Hoist** | Up | UP (B1) | Down | DOWN (B2) |
| **Trolley** | Left | NORTH (B3) | Right | SOUTH (B4) |
| **Bridge** | Forward | EAST (B5) | Reverse | WEST (B6) |

# Appendix 1 - European Radio Regulation

Exerpts from ERC RECOMMENDATION 70-03:

| Frequency Band | | Power / Magnetic Field | Spectrum access and mitigation requirement | Channel spacing | Notes |
|---|---|---|---|---|---|
| f | 433.050-434.790 MHz (note 4) | 10 mW e.r.p. | < 10 % duty cycle (note 1) | No spacing | |
| f1 | 433.050-434.790 MHz (note 4bis) | 1 mW e.r.p. -13 dBm/10 kHz | No requirement | No spacing | Power density limited to -13 dBm/10 kHz for wideband modulation with a bandwidth greater than 250 kHz |
| f2 | 434.040-434.790 MHz (note 4bis) | 10 mW e.r.p. | No requirement | Up to 25 kHz | |
| g | 863-870 MHz (note 3, 4 and 6) | ≤ 25 mW e.r.p. | ≤ 0.1% duty cycle or LBT (note 1 and 5) | ≤ 100 kHz for 47 or more channels (note 2) | FHSS modulation |
| | | ≤ 25 mW e.r.p. (note 6) Power density : - 4.5 dBm/100 kHz (note 7) | ≤ 0.1% duty cycle or LBT+AFA (note 1, 5 and 6) | No spacing | DSSS and other wideband modulation other than FHSS |
| | | ≤ 25 mW e.r.p. | ≤ 0.1% duty cycle or LBT+AFA (note 1 and 5) | ≤ 100 kHz, for 1 or more channels modulation bandwith ≤ 300 kHz (note 2) | Narrow /wide-band modulation |
| g1 | 868.000-868.600 MHz (note 4) | ≤ 25 mW e.r.p. | ≤ 1% duty cycle or LBT+AFA (note 1) | No spacing, for 1 or more channels (note 2) | Narrow / wide-band modulation. No channel spacing, however the whole stated frequency band may be used |
| g2 | 868.700-869.200 MHz (note 4) | ≤ 25 mW e.r.p. | ≤ 0.1% duty cycle or LBT+AFA (note 1) | No spacing, for 1 or more channels (note 2) | Narrow / wide-band modulation. No channel spacing, however the whole stated frequency band may be used |
| g3 | 869.400-869.650 MHz | ≤ 500 mW e.r.p. | ≤ 10% duty cycle or LBT+AFA (note 1) | 25 kHz (for 1 or more channels) | Narrow / wide-band modulation The whole stated frequency band may be used as 1 channel for high speed data transmission |
| g4 | 869.700-870.000 MHz (note 4bis) | ≤ 5 mW e.r.p. | No requirement | No spacing (for 1 or more channels) | Narrow / wide-band modulation. No channel spacing, however the whole stated frequency band may be used |
| | | ≤ 25 mW e.r.p. | up to 1% duty cycle or LBT+AFA (note 1) | | |

**Note 1:** When either a duty cycle, Listen Before Talk (LBT) or equivalent technique applies then it shall not be user dependent/adjustable and shall be guaranteed by appropriate technical means.
For LBT devices without Adaptive Frequency Agility (AFA), or equivalent techniques, the duty cycle limit applies.
For any type of frequency agile device the duty cycle limit applies to the total transmission unless LBT or equivalent technique is used.

**Note 2:** The preferred channel spacing is 100 kHz allowing for a subdivision into 50 kHz or 25 kHz.

**Note 4:** Note 4: Audio and video applications are allowed provided that a digital modulation method is used with a max. bandwidth of 300 kHz.
Analogue and digital voice applications are allowed with a max. bandwidth ≤ 25 kHz.
In sub-band 863-865 MHz voice and audio conditions of Annexes 10 and 13 of ERC/REC 70 – 03 apply respectively.

**Note 4bis:** Audio and video applications are excluded. Analogue or digital voice applications are allowed with a max. bandwidth ≤ 25 kHz and with spectrum access technique such as LBT or equivalent. The transmitter shall include a power output sensor controlling the transmitter to a maximum transmit period of 1 minute for each transmission

**Note 5:** Duty cycle may be increased to 1% if the band is limited to 865-868 MHz.

**Note 6:** For other wide-band modulation than FHSS and DSSS with a bandwidth of 200 kHz to 3 MHz, duty cycle can be increased to 1% if the band is limited to 865-868 MHz and power to ≤10 mW e.r.p.

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